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Land Policy

At its annual meeting in Cincinnati in December, 1948, the Soil Conservation Society of America drafted a statement of land policy, the basic premise of which was that: "All land should be used in a manner which will insure its continued and permanent maximum productivity and values." The statement continues:

To adopt and effect such a policy, the following requirements must be recognized nationally:

The conservation of soil, water and interdependent renewable resources involves scientific study and guidance, necessitating the bringing together as a single function many facets of a vast number of scientific fields; therefore, the science of soil and water conservation is intricate and complex.

An inventory of all physical land resources and their condition is of primary importance to serve as the proper guide to the utilization and treatment of these resources.

Specifically the widespread adoption of a sound land policy should comprehend the need for conservation, development and utilization of land and water resources for: (1) sustained and improved agricultural production, (2) forest protection, re-growth and sustained yield, (3) prevention of erosion and flood damage to safeguard land from overflow and siltation, (4) protection of community and industrial water supplies, (5) maintenance of underground water sources, (6) development and installation of irrigation and drainage as needed to extend appropriate land use and conservation, (7) protection and maintenance of fish and wildlife in accordance with proper land use, (8) development and utilization of areas most appropriately suited for needed recreational purposes, and (9) protection, and, in certain cases, revegetation of areas suited to range utilization.

The ultimate goal in land use is a complete soil and water conservation program on every farm, ranch, forest, and watershed throughout the country.

To functionalize the above land policy and the specific principles involved, the Soil Conservation Society of America recognizes that:

The conservation of soil and water by efforts of the individual land-owners and operators is the most important contribution that can be made to the carrying out of this land policy. Locally and democratically organized groups of land-owners and users are the best known vehicles for carrying out soil and water conservation programs designed to improve and perpetuate the productivity of our basic natural wealth—the land.

Private ownership of land is, for the most part, the most suitable system under which a National Land Policy can be effective. It is recognized, however, that good management, public interest and welfare necessitate public ownership and administration of certain land areas.

The technical, educational, financial and other services necessary to the adoption of a fully coordinated land use program should be thoroughly integrated and cooperatively performed, to carry out this land policy and all its principles.

Private, corporate, and allied groups have a major responsibility in obtaining adoption of this land policy and in the conservation of soil and water.

A workable method of carrying out coordinated programs of land use, soil and water conservation requires the joint and cooperative efforts of the federal, state, and local governments which are, or may become, engaged in these endeavors. It is also necessary that the administrative forces charged with such activities be given explicit responsibilities for contributions to such coordinated programs.

In a great measure, our natural economy, our democratic process and our national security are dependent on the future conservation and use of our basic natural resources. These proposals, therefore, are made in the interest of the public health, safety, and general welfare of all the American people.

For Olympic Park

Olympic Park Associates is the name selected for a group organized in Seattle "to preserve the integrity of the Olympic National Park in accordance with the fundamental purposes of national parks; which is to conserve the scenery and the natural and historic objects and the wildlife therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." While the move to remove certain areas from the Olympic Park so that lumbering may be carried on is at the moment quiescent, it is bound to flare up again. It is heartening to have a strong group right on the scene. Irving M. Clark is president of the new group, Leo Gallagher vice-president, and John Osseward secretary. Trustees are Mrs. W. W. Barr, Mrs. Thomas Pelley, Arthur Winder, Major J. Griswold, H. W. Higman and Ellsworth Lumley. Officers and trustees also represent many local and national conservation groups, all of which took an active part in repelling the first attempt to invade the park.

Illinois Birds

"Invitation to Birds" is the title of an attractive 64-page booklet by Virginia S. Eifert, published by the Illinois State Museum and made available free for use in the schools of the State. Mrs. Eifert also supplied the attractive illustrations. Besides considering some of the common birds of Illinois, and extending an invitation to know and enjoy them, the booklet gives practical advice on attracting birds, building and locating bird houses and feeding birds.

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Nature in Print

By HOWARD ZAHNISER

YEARS AGO Paul H. Oehser, whose poems and articles have appeared in this magazine from time to time, copied a quotation from La Bruyere into a volume that he was presenting to me—a sentence of rather excellent advice to reviewers, I would surmise. Said La Bruyere: "Where a book raises your spirit, and inspires you with noble and courageous feelings, seek for no other rule to judge the event by; it is good and made by a good workman."

On the publication of Mr. Oehser's own first volume—*Sons of Science: The Story of the Smithsonian Institution and Its Leaders*—it is indeed a pleasure to be able, in all good conscience, to remind so good a friend of this quotation, and to have such classic encouragement in a hearty commendation.

In the very first place, the volume's title is good and descriptive. On the occasion of Leonhard Stejneger's ninetieth birthday—in 1941—Mr. Oehser wrote a special sonnet opening with the lines:

> The sons of science walk in endless line
> Bearing the torch; a few falter and drop,
> But the rest close in: they who have glimpsed a sign
> Far on ahead that reads, "You must not stop!"
> Their quests are strange and wonderful—to bring
> The stars to earth, to take the earth to sky;
> To know the *what* of every living thing
> Of all time past, and then the *how* and *why*.

In these verses I feel the expression of a reverent, almost devotional, respect, and quite fittingly from them comes the title phrase for this history of our great national scientific institution—the Smithsonian—which Mr. Oehser has told in terms of the lives of the men who have made it.

Doubtless it is this manner of telling—together with the author's attitude toward science and scientists and his loyalty to an institution he himself has served for nearly two decades—that gives to *Sons of Science* its power to raise the spirit, as La Bruyere would say, its power to inspire a reader with noble and courageous feelings. The book itself is as straightforward and factual a narrative as any historian might wish for, but its history is essentially biography of men in a noble setting. The facts of the lives of these men as they have related themselves to an institution for the "increase and diffusion of knowledge among men" are items of nobility, and while Mr. Oehser has written no "tributes," or given himself over to a personal expression of his feelings about his heroes, he has recorded the facts of their effort and their accomplishments so skillfully as not to conceal their noble qualities.

The truth is that the Smithsonian Institution and its leaders—from its generous founder, the British chemist James Smithson, to its present head, the great ornithologist Alexander Wetmore—are viewed by all Americans with a friendly reverence. Its heads in days gone by—the physicist Joseph Henry, the biologist Spencer Fullerton Baird, the physicist and astronomer Samuel Pierpont Langley, the geologist Charles D. Walcott, the astrophysicist Charles G. Abbot—are among our historic great men. These men's lives are the topics in Mr. Oehser's history of the Institution—these and a few others. Perhaps, indeed, his finest chapter is "George Brown Goode, the Young Genius," an especially understanding narrative of the brilliant accomplishment of one who, but for his early death, would apparently have belonged formally in the succession of heads of the Smithsonian. It seems compassionately fair of Mr. Oehser not to allow death to crowd him also out of the succession in *Sons of Science*. There are a few others who are more than mentioned—notably Robert Ridgway, who followed "in Baird's footsteps as the foremost ornithologist of his day," and whose career is here sketched. And throughout one has the sense that he is reading of the work of many men.

Of special interest to many readers, particularly those who have been impressed with visits to the Smithsonian, will be Mr. Oehser's account of James Smithson, the remarkable bequest that he made to the United States, and the tense debates and deliberations from which the Institution emerged. Perhaps Mr. Oehser's dedicatory poem to Smithson will live with the Institution, and one feels confident that this "lonely man," who sought "to perpetuate his name and at the same time to serve the human race," would feel richly honored. As Mr. Oehser records the fact in his text: "Faced, at the age of sixty-one, with the problem of disposing of his fortune of about £100,000, James Smithson, a bachelor Englishman, drew up a will that made history in the field of science." It will make all of us value all the more this great institution, in which we all share, to know these facts in its history.

There is, also, a remarkable amount of information about the history and literature of science in this country included in this volume, and of course it makes vividly clear just what the Smithsonian is, adding thus to our knowledge in another sphere. It would be a fine thing if every visitor to the Smithsonian could carry home a copy of this book—a fine thing for the visitor and for all that the Smithsonian represents—and one must agree also with its publisher, who predicts that "everyone—of high school age and up—interested in biography, or history, or science, will enjoy Mr. Oehser's very readable account."

In 1946 the Smithsonian Institution celebrated the hundredth anniversary of its founding. Dorothy Stimson, in a companion volume to Mr. Oehser's *Sons of Science* (both appearing in the new Life of Science Library), tells somewhat similarly of an institution that will celebrate in 1962 its three hundredth anniversary. This is, of course, the Royal Society, of London, "the world's oldest scientific body in continuous existence."

It has been an inspiration, also, to read Dr. Stimson's book, nicely entitled *Scientists and Amateurs: A History of the Royal Society*, and to sense the wisdom and perspective that have come to her in the course of her researches. There is also a distinct charm in reading of the early beginnings of this Society, and there is, too, a perhaps somewhat quaint interest throughout the volume in the way the affairs of the Royal Society have been conducted. These are qualities of interest added, of course, to the dominant interest in the factual history that Dr. Stimson is telling. It is not possible in this volume to serve so well the concern with biography that Mr. Oehser has, three centuries here being compacted into practically the same size volume that he gave to one, but Dr. Stimson is duly sensitive to the interest in personality, and her book, too, is eminently readable. Compelled, as she is, to see her institution more steadily, perhaps, as a whole, she does, indeed, give us a sense of its existence as a vital entity through the course of three centuries of history. This surely is something to value highly.

"How did it happen," Dr. Stimson asks, "that a society of notable men in the London of the seventeenth century should so have transformed itself that by the twentieth century the organization had become a guide and leader in scientific progress?"

"As often happens with living organisms, the changes," she continues, "were not continuously directed toward one goal, nor was that goal envisioned by the men directing the Royal Society's fortunes. The Society proved that it had an enduring vitality within itself. Thus it eventually overcame its handicaps, survived its periods of stress and gradually emerged into its present position of power and prestige."

Scientists and Amateurs is Dr. Stimson's more detailed, and very human, account of this development.

The Life of Science Library, in which these volumes appear, is "by these presents" a series to be welcomed. Annotations, bibliographies, and indexes are completely included, making the volumes useful for more careful study and reference. The text, however, is considerate of the general reader, profound

though the subject may be, and should appeal even to the more serious high school students. This is true not only in vocabulary and phrasing, but, as has been indicated, in the inclusion of incident and anecdote of "human" as well as significant interest. The illustrations are likewise of both value and interest, and, although one might wish for a brighter reproduction of them, he can be thankful for the generous space devoted to them. The general typography of the books is clear and satisfying.

We shall look forward to other volumes in this series.

Sons of Science: The Story of the Smithsonian Institution and Its Leaders. By Paul H. Oehser. New York: Henry Schuman, (In "The Life of Science Library.") 1949. 220 pp., with 39 photographs on 32 plates, chronology of principal events in Smithsonian history, selected bibliography, and index. $4.

Scientists and Amateurs: A History of the Royal Society. By Dorothy Stimson. New York: Henry Schuman. (In "The Life of Science Library.") 1948. 270 pp., with 20 photographs on 17 plates, bibliography and sources, and index. $4.

Flight of Birds

The Flight of Birds. By John H. Storer. Bloomfield Hills, Michigan. 1948. Cranbrook Institute of Science. 94 pages. Illustrated. $2.50.

Many bird and wildlife enthusiasts have seen the remarkable motion pictures in color that John H. Storer has taken in slow motion to show the flight characteristics of many species of birds. These pictures, besides providing beauty, entertainment and information for outdoor-minded people, have also been a sort of moving laboratory for the study of bird flight. Studying them, Mr. Storer has distilled information on flight of birds that are as extreme in size as the hummingbird and the American egret. The concise information that he presents in this little book will be of interest to all bird students and will enhance their enjoyment of bird watching.

Avian Egg

The Avian Egg. By Alexis L. and Anastasia J. Romanoff. New York. 1948. John Wiley and Sons. 906 pages. Illustrated. $14.00.

The broad scope of this 906-page new book makes it useful to biologists, chemists, poultrymen, and nutritionists alike. Presenting the results of more than twenty years of research on birds' eggs, the authors of *The Avian Egg* stress the value of eggs in the diet, in science, and in industry. Dr. and Mrs. Romanoff gathered information for the comprehensive treatise not only from their own long experience in the field but also from periodical literature on the subject published in all parts of the world. Having examined nearly 15,000 scientific publications during the preparation of their book, they cite 2600 key references to the most up-to-date and significant journal reports for readers desiring further information.

The Avian Egg covers first the laying, formation, external characteristics, structure, and abnormalities of the egg. In this introductory section, variability and its causes are especially emphasized. Part II presents in great detail the chemical and physical properties of the egg and explores interesting but less familiar aspects of the egg's biological potentiality. The economic and nutritive aspects of the egg are analyzed in the third section, where the authors evaluate its importance in human life and survey its food value, methods for its preservation, and its uses in industry and in medical research.

Alexis L. Romanoff has spent nearly 25 years investigating the basic biological constitution of the avian egg. His laboratory at Cornell University was the first ever set up solely for studying the eggs of domesticated and game birds. In addition to much intensive research in avian embryology—he is Professor of Chemical Embryology at Cornell — Dr. Romanoff has helped solve practical problems in artificial incubation and in the preservation of eggs as food. Anastasia J. Romanoff, co-author with her husband of many scientific articles, has studied chemistry, bacteriology, and medicine in this country and abroad. She has also had considerable teaching and research experience.

Botanical Names

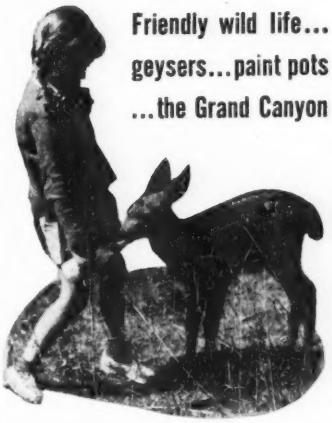
International Rules of Botanical Nomenclature. Compiled by W. H. Camp, H. W. Rickett and C. A. Weatherby. Waltham, Mass., Chronica Botanica Co.; New York City, Stechert-Hafner, Inc. 1948. 120 pages. $3.50.

This is an unofficial special edition brought out as a service to members of the American Society of Plant Taxonomists in anticipation of the participation of that Society in the next International Botanical Congress. Previous congresses have formulated and revised the rules, which appear still in a state of flux. This is a taxonomic document of highly specialized but valuable character.

All About the Fig

The Fig. By Ira J. Condit, with foreword by Walter T. Swingle. Waltham, Mass. 1948. The Chronica Botanica Co. New York, Stechert-Hafner, Inc. 22 pages. Illustrated. $5.00.

This is the only modern book on the fig, dealing with its interesting and extensive history, its botany, horticulture, economics, diseases and entomological aspects. The author is Associate Professor of Subtropical Horticulture at the University of California Citrus Experiment Station. His work is a most important botanical contribution, of interest to fig culturists and to botanists.



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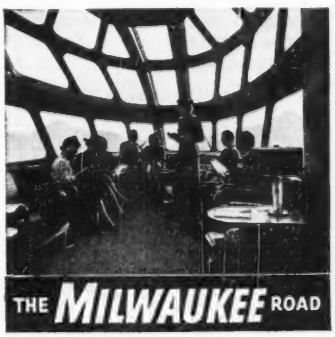

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PUBLISHED BY THE AMERICAN NATURE ASSOCIATION

To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great National Resources of America

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NATURE MAGAZINE is published monthly, October to May, inclusive, bimonthly, June to September, inclusive, by the American Nature Association. Entered as second-class matter May 31, 1927, at the post office at Washington, D. C., U. S. A., and accepted for mailing purposes at the special flat rate of postage provided for in the United States Postal Act of October 3, 1917, and February 28, 1925. $4 a year; foreign $4.75.

Publication and Editorial Office, 1214 16th Street, N. W., Washington 6, D. C.

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Are You a "Nut"?

This is the question that W. Scott Lewis asks in the heading of his little essay on the first pages of his *Mineral Bulletin* for January. And the manner in which he answers the query is, as usual, worth passing on. Responding to the question, he says:

"Well, if you are not just a wee bit 'touched', you must be a somewhat superior type of individual. Of course it could mean that your I.Q. is a bit low except for the fact that people with a low I.Q. never read this *Bulletin*.

"The present age with its rush and nerve strain and worry is anything but healthy for the most of us and it is no wonder that the number of psychotics (no one is insane any more) is rapidly increasing. The population of state hospitals is jumping at the rate of 12,000 a year and 41 percent of all hospital beds are required for mental patients who are most inadequately cared for.

"Then there is the vastly greater number of neurotics of every shade and description who never land in an institution, except now and then when one succumbs to an inner urge to poison his mother-in-law, or do something equally desperate. No one knows how many there are, but psychiatrists say we would be astonished if we knew. In fact they hint that practically everyone (except, of course, a psychiatrist) is at least a tiny bit afflicted.

"Fortunately most neurotics and at least some psychotics can be cured, the only trouble being that the cure works best with those in the higher income brackets. You see the cost is a bit expensive. A psychoanalysis, for instance, runs from $10 to $50 an hour, and treatments are given five times a week and may run for 100 weeks if the patient's bank account holds out that long. All we can say is that if we have any cracks, dents, warts or other afflictions of our unconscious, subconscious, id or other sections of our mental anatomy, they will just have to remain cracked or dented as we could not raise the money to have them welded, vulcanized, hammered out or otherwise treated.

"We have learned one thing, however, that pleases us greatly. It seems that the leading institution for the cure of the mentally sick in this country (rates only $650 a month) has discovered the value of hobbies. The doctor who founded it, a fine gentleman of 84, teaches the patients mineral and shell collecting, while his son, who is none other than Dr. Will Menninger, the president of the American Psychiatric Association and the leading promoter of psychiatric activity in the country, goes even farther, adding the hobbies of stamp collecting, butterfly collecting and bird study. It seems that several hobbies are better than one. We maintain that what helps to cure can also help to prevent, and so we are glad to recommend all of the above-mentioned hobbies. Keep up your collections and your Nature study and you may also keep sane in a world of psychotics."

Land Conservation

Reporting for the fiscal year 1948, Hugh H. Bennett, Chief of the Soil Conservation Service, sees a narrowing of the gap between land deterioration and land conservation in the United States. He feels that we can see the goal of a permanent agriculture more certainly in sight "if we but speed up our efforts." Twenty-two and one-half million acres of land in 1948 had soil conservation measures applied to them, a seven percent increase over 1947. Increased experience on the part of technicians resulted in greater efficiency and higher results. Dr. Bennett asserts, in his report, that we can overcome and control erosion within twenty to thirty years if we will sharply step up present conservation operations on the land. To that end he makes the following recommendations:

1. Set up a timetable for the establishment of those basic measures needed for the conservation of our soil and water resources, according to capability of the land and availability and need of the water.

2. Adjust research in conservation to specific problems encountered in field work and intensify research on those problems.

3. Encourage and promote a comprehensive program of conservation education through all available educational agencies and institutions.

4. Complete land capability surveys of the country and analyze the information to provide land facts needed for future farm planning and action.

5. Recognize and use land capabilities in making production adjustments and in developing other agricultural programs.

6. Encourage continued organization of soil conservation districts, in order to develop conservation programs with local leadership and direction.

7. Improve the conservation credit structure.

Plant Nutrition

Lectures on the Inorganic Nutrition of Plants. By D. R. Hoagland. Waltham, Mass., Chronica Botanica Company; New York City, Stechert-Hafner, Inc. 1948. $4.50.

This is a collection of the Prather Lectures at Harvard University delivered by the Professor of Plant Nutrition at the University of California. The collected material seeks to present a general perspective of several important aspects of the field of plant nutrition, and to focus attention upon some of the problems of the soil-plant system that need further exploration.

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BRITISH RAILWAYS

Annual Meetings

American Nature Study Society

THE American Nature Study Society joined with four other science teaching societies in Washington, December 27-30, 1948, to hold its annual meeting and mark its 41st year of leadership in promoting the conservation concept and other progressive ideas in Nature education.

Three general morning sessions, sponsored jointly by the five societies, took the form of panel discussions held in the Hall of Nations Room of the Hotel Washington. Here also were exhibits, prepared by government and private agencies concerned with conservation and science education. Student science projects were included among the displays.

The ANSS programs, in the afternoons, brought together writers, educators, and scientists of national reputation in round table discussions.

"Conservation Issues Today" drew the largest audience. Its panel included Ira N. Gabrielson, President of the Wildlife Management Institute; William Vogt, of the Pan American Union and author of *Road to Survival;* Ruth Gilmore, conservation legislation chairman of the National Council of State Garden Clubs; Devereux Butcher, Secretary, National Parks Association; and Howard Zahniser, Secretary, The Wilderness Society.

Chairman of the panel, Richard W. Westwood, editor of *Nature Magazine,* guided the discussion, which ranged from world issues of growing populations and dwindling natural resources to everyday, personal conservation problems such as the individual's wasteful handling of wood products, water, and irreplaceable metals.

Encouraging reports on the accomplishments of recent international conservation conferences at Fontainbleau, France, and Denver, Colorado, were made by Gabrielson and Vogt.

Among the pressing conservation issues discussed were: (1) Destructive impact of dams and reclamation projects on other natural resource values; (2) Hazards of widespread, uncontrolled use of chemical poisons (insecticides and weedicides); (3) Preservation of national forests, national parks, and wilderness areas in the face of increasing economic and population pressures; (4) Haphazard handling of the large, potentially productive, privately owned forest lands and woodlots; (5) Political domination of at least 50 percent of the wildlife management agencies, and the growing hunting and fishing pressures on wildlife populations; (6) Development of enlightened leadership among hunting and other outdoor groups—potentially the greatest conservation influence in the country; (7) Conservation education that will awaken the city dweller to the impact of resource waste on "his own pocketbook and stomach."

President Edwin Way Teale led the panel discussion on "Nature in Everyday Living." Using Kodachrome slides, Raymond Gregg, of the National Capital Parks, showed the varied, extensive Nature recreation program his organization is bringing to the public in the Washington area. Artist and ornithologist Roger Tory Peterson spoke of the need for capable popularizers of natural science to supply the "kindling" that will set fire to the substantial "logs" of interest, leading the reader to delve more deeply into a subject. Peterson also stressed the great recreational value of Nature hobbies to professional people and to others who lead a "high pressure existence."

Ted Petit, in charge of publications, Boy Scouts of America, outlined revolutionary changes in the Scout advancement program. Much greater emphasis will be placed on conservation activities, he declared. A detailed report on the new policy will appear in this column at a later date.

Election results were announced as follows: Pres., Richard W. Westwood; Vice-pres., Ellsworth Jaeger; Sec.-Treas., Richard L. Weaver; AAAS representative, E. L. Palmer; editor, Dwight E. Sollberger. Directors for 1949-50: Allan D. Cruickshank, Eva Gordon, Raymond Gregg, Charles E. Mohr, and Edwin Way Teale.

The other societies participating in the general sessions and in the joint banquet were the National Association of Biology Teachers, the National Science Teachers Association, the National Council for Elementary Science, and Section Q (Education) of the AAAS.

Theme for the general meeting was: "Meeting the Needs of Society Through Science Education." The opening panel was devoted to "Curriculum Development in Science." It was led by Richard L. Weaver, who made an eloquent plea for the gearing of teaching both at secondary and college levels to recognizing and dealing with real-life community problems.

National Association of Biology Teachers

IT WAS difficult to attend the joint meetings of the organizations interested in the teaching of science and not reflect on how the founders of some of these societies would have reacted to the offerings of the organizations they sponsored. Certainly they would not have been disappointed.

Among the effective joint meetings was the banquet at which representatives of each of the groups, paced by Edwin Teale, President of the American Nature Study Society, presented a picture of the offerings of their respective groups. Howard Michaud presented a picture of the growth and development of the National Association of Biology Teachers, and passed the gavel of the organization on to the new president, Ruth A. Dodge, whose place as president-elect is taken over by Dr. Betty Lockwood.

One of the most interesting joint meetings was the program put on under the direction of Keith Johnson and representing the work of the Science Clubs of America. The young folks represented a good cross-section of youth interested in science. They presented and defended well a number of conflicting points of view. It seemed obvious that they spoke primarily from an urban background, with a strong focus on the role science might play in medicine and in industry, and one was not surprised to hear one speaker comment on her conviction that there was comparatively little science in agriculture. This was a refreshing viewpoint, although one better-informed speakers might have been unwilling to defend.

The meetings of the National Association of Biology Teachers were planned by the new president, Ruth A. Dodge. They continued the practice established some years ago of dealing with one important phase of biology. In the last three years emphasis has been given to conservation, ecology and biological sensitivity. Under these circumstances, the program this year, dealing with health, provided a welcome innovation. Since the different sections emphasized research, supervision and teaching in the field of health, one was able to get a representative picture of health education as a phase of teaching biology. This was particularly worthwhile, since the speakers represented those with experience in research, in administration and in teaching at different scholastic levels.

By Airfreight

There is never a dull moment, apparently, in the lives of pilots of freight-carrying planes of American Airlines, whose publicity department has gone to the trouble of compiling a list of odd Airfreight consignments in 1948. These included a parrot flown from Mexico City to San Antonio, only to be refused entry because it used profane language; sixty pounds of soil flown to the Cotton Bowl so that the Oregon football team would not be on "foreign" soil; a plane loaded with one crate of baby chicks, two monkeys, three crates of prize turkeys, five crates of chinchillas, two canaries, a stone-deaf kitten, three dogs and two crates of fancy pigeons; a lion shipped to Syracuse so a local political leader could pay an election bet by parading with it; a chimpanzee flown to Hollywood for a screen test, which was successful; two alpine goats as pets for a woman who attributed her recovery from tuberculosis to goat's milk.

A BALTIMORE GARDEN

By BERTHA LEWIS CLARK

One Sunday afternoon recently, while out walking in Roland Park, I came to an old garden. The gate stood invitingly ajar. As I stood gazing wistfully through the entrance, a little brown bird went flying in unafraid. His boldness reassured me; and, assuming that the unpretentious are always welcome, I followed him.

Within, under the glow of the setting sun, lay an autumn land of enchantment. A stone-paved walk, overrun with ivy and bound by cedar trees and mountain laurel bushes, led from the gate to a wide terrace, which dropped away in a series of rocky ledges to a pond-filled ravine. In the crevices of some ledges, mosses, ferns and mountain tea grew in long green clusters; in the worn hollows of others little pools of water had collected. These were not much larger than the cupped hands; but, as I learned by watching my brown friend disport in one of them, they were big enough to serve for birds' bathtubs. Others, entirely bare, formed rough stairways to the cattails and brownish grasses that fringed the pond. In the flaming sunset the grasses, ordinarily so insignificant, were unusually lovely.

Beyond the pond, there was a deep meadow that spread out in uneven grassy ripples like a beach at ebb tide. Occasional patches of mountain laurel, rhododendron and holly, combined with fruit-laden chokeberry and barberry bushes, broke the outer edge of the lawn. Here and there a tall pine or hemlock towered; here and there the bare limbs of a beech or sycamore were outlined against the sky. Even the dead leaves added to the beauty of the scene, for the wind had swept them into long, graceful curves from the foot of the trees all the way to the old ivy-hung stone wall. This piece of masonry was the garden's stronghold against civilization—the city street.

As I sat on the terrace in the silence, my foot accidentally struck a stone. It bounced noisily down into the ravine and awoke all the life of the garden. Immediately Mr. and Mrs. Cardinal flew in to dine on cedar berries. Although the madam shied away to hide in the bushes, the master, unmindful of me, whetted his bill, between mouthfuls, on a bough almost over my head. Just about that time a lean squirrel frisked across the lawn, and two other squirrels commenced to play hide and seek up and down the trunk of a hickory tree. Then a flock of grackles, their black feathers shining in the sun like green and purple satin, fluttered down and began to devour something scattered on the grass. This I discovered later was cracked corn that had been placed there for them. As a matter of fact, the whole occurrence was natural enough, but it made me feel like Cinderella's godmother.

At last the sunset faded away, and the garden became shadowy and remote. As my woodland friends one by one departed, I, too, with a sigh, arose to go. Then a strange thing happened. The wind took my little sigh and carried its gentle grieving all around the place. By the time I reached the gate, it was shaking the cedar tree on the left of the entrance. But the cedar did not pass the sigh to the laurel bushes at the right of the path. No, he threw it to a great oak out in the city street. Thus it was that my sigh and I came away from the garden.

Merited Award

Thomas Z. Atkeson was a biologist at the Wheeler National Wildlife Refuge from 1939 until his entry into the Army in 1942. He became a captain of cavalry and lost both arms below the elbow and was blinded by a land-mine explosion. He returned, however, to his civilian post in 1946, and, with the assistance of a Veterans Administration-employed reader-helper (also a disabled veteran), negotiates contracts and collects rent from tenant farmers who cultivate land on the Wheeler Refuge, performs public relations work, bands migratory waterfowl and collects biological data on southeastern wildlife refuges. Mr. Atkeson has been awarded the 1948 Blinded Veterans Association Achievement Award as "the blinded veteran who has demonstrated outstanding achievement in his chosen field of endeavor."

Boys and Girls Week

National Boys and Girls Week will be observed from April 30 to May 7 this year. The theme will be "Building for Citizenship," and the program is designed to focus the attention of the public on the interests, activities and problems of youth. The activities planned for the observance emphasize important factors in the growth of youth, including citizenship training, education, recreation, occupational guidance, home life, religious education, health and safety, understanding among nations and peoples, conservation of natural resources and membership in boys' and girls' organizations. Information about the Week and suggestions for programs may be obtained from National Boys and Girls Week Committee, 35 East Wacker Drive, Room 950, Chicago 1, Illinois.

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The School Page

By E. LAURENCE PALMER

Professor of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

ICE, IN SCHOOL AND OUT

ELSEWHERE in this magazine I give you an article on ice in the hope that it will suggest a few activities to be carried on, in school and out, and lend a new significance to the study of our environment. We often learn much, in such subjects as physics, that we fail to apply to what we see in Nature in general. Yet some of the more profound ideas were made originally significant by remarkably simple experiments.

If the ice covers some roof-top that is accessible, some river or pond, or some other surface over which it may move, it is distinctly worth while to try at least two things. First, drive a series of stakes, or other markers, in a straight line across the ice. It might be well to place these at reasonably regular distances. For a large river, fifty-foot distances might be suitable, while for a smaller area the distances might be as small as a few inches. Keep a record of the distances agreed on, and of the temperatures at the times the markers were set. Also keep records of the temperatures on succeeding days. Every day or so examine the markers to see if they are still in perfect line, and measure some of the distances to see if they have increased or decreased. Keep a careful record of the resulting statistics.

It might be well to supplement the above suggestion with that of establishing at least one line of markers at right angles to the first, and keeping similar records of what happens to it. Of course, I cannot predict exactly what will happen, but I am confident that many of you will be surprised at the results. And I am sure that you will be able to use the results to help you understand some of the things you see happening in Nature.

A simple experiment was suggested to me by Dorothy Alfke of the Oneonta Teachers College. It shows how the volume of ice is related to the volume of water involved. Simply fill an ordinary milk bottle full of water. Thrust an icicle into the bottle until it is completely covered with the water. Of course, some of the water will be forced out. Now, let the icicle melt and see if the water melting from the icicle is sufficient to fill the bottle again. Of course, if the volume of water represented by the icicle is greater than the space occupied by the icicle when submerged, then, the bottle will be filled to overflowing when the icicle has melted.

Lois Odell of Towson Teachers College has suggested an interesting experiment dealing with the formation of icicles. She sprinkled different colored dyes on the snow above an eave where icicles were forming. As the water from the lower areas melted and ran down, helping in the growth of the icicles, it left ice of one color. When this was followed by water of another color from higher up, it formed ice of still another color. In this way, she could trace the origin of the water in her icicles. We are now using somewhat similar techniques for tracing all sorts of things through plants and animals. Particularly is this so where we can watch the movement of radioactive substances through organisms. What we have found and will find by this method of investigation is and will be most important. There is no reason why a child in school may not get some idea of the system by studying icicles on the roof of some shed.

In the earlier article, we suggested that some of us had learned some things about ice by making snowballs and by licking icicles. The influence of pressure and of temperature was easily observable when a snowball was packed to icy hardness. When one's tongue becomes frozen to an icicle on a bitter cold day, he can easily get some idea of what happens to water that may trickle down over an icicle under similar temperature conditions. The growth of an icicle is, under these circumstances, more easily understood. We do not, of course, recommend that children try to lick icicles on bitter cold days because it may be dangerous, as you no doubt know.

Icicles are ideal units of ice with which to experiment. We suggested suspending some of them so that they were horizontal instead of vertical to see how they may bend of their own weight, and cause us to have some reservations about believing that ice is as brittle as we might think. They also give us an excellent opportunity to study, and to demonstrate, sublimation whereby a solid may pass directly into a gaseous state. To demonstrate this, let us suggest that you suspend a spring balance outside a window in winter. From it, suspend an icicle large enough to have considerable weight. Beneath the icicle, spread something that would collect any moisture that might be lost in drops. Watch the balance through the days to see if the icicle loses weight without going through the process of melting. Some of your pupils will have to correct their ideas about the water cycle after carrying on this experiment, and may well question some of the statements they may find in elementary and in secondary school texts after they have tried experimenting with their icicles. If they do begin to question what they have been told, or what they have read, they may really at last be making a beginning in the study of science. As a youngster, I know I never could understand how clothes, hung wet on a line, could "freeze dry" without upsetting what I had been told about the water cycle.

Interesting studies in the size of ice crystals may often be made by observing their relative size above and below the icy covering of a brook that has decreased in volume after the ice covering was formed. Below the covering, the temperature has, of course, remained constant and the humidity of the air has remained constant for a relatively long time. Above, both may change with the weather of the day or night, or be affected by the heat of the sun. Can you read some significance into the fact that the crystals below the icy arch are larger than those to be found above? If not, make a try at it again and then try to translate what you conclude into an interpretation of the variation in size of crystals of other substances than water.

It should be noted that in the suggestions we have made here we have spoken only of experiments that may be made with frozen water as it is found in Nature. Should we attempt to carry our studies to the effects of freezing on other substances we could increase the possibilities offered for interesting discoveries. With our modern electric refrigeration, and with the presence in almost any school building of an electric refrigerator, the possibilities of observing the effect of freezing and of thawing water, for the purpose of learning from what we see, are multiplied. The physics books are full of interesting information if you can read them intelligently, but much of this is in such form that it is useless to the amateur who wishes to interpret his own environment. All we can suggest is that you do not pass up the opportunity to study ice wherever you may find it, in school or out.

Contents Noted

FRANKLY, we are bemused. When we, on occasion, make so bold as to be critical of gunners we are promptly sneered at as anti-hunting blue-noses. Yet we read, in *Field and Stream,* the following two paragraphs by Ted Trueblood, a member of that publication's staff, who says:

"I say with regret that the overwhelming majority of men and women who hunt and fish are interested solely in killing more game and catching more fish. Nearly all of them either are deliberate game-law violators or else are restrained from violation only by the fear that they will get caught. This applies everywhere, regardless of race, creed, color, or financial status.

"I know a great many hunters and fishermen. Among them all, I can almost count on my fingers the men who would not exceed the limit or take game and fish out of season if they were sure they would not be arrested."

We have said substantially the same thing, in even less drastic terms, only to be clocked up as members of a holier-than-thou clan. And now comes Nash Buckingham, chairman of the Outdoor Writers Association of America's Waterfowl Committee, and a gunner from way back, with the following two paragraphs:

"Wildfowling seasons have come to a close, and with it an at least legal end to probably the greatest saturnalia of law violations and illicit chiseling and downright slaughter ever chronicled in a sportingly decadent nation on the verge of gunning frustration as to the future of such sport. We say 'come to a close' advisedly; for it is freely predicted that in many of the latest closing states down south there'll be more ducks and geese killed, post-season and pre-season, than there were during the open sessions.

"Worse still, these crimes against wildlife are not being confined to waterfowl. Big game herds, especially, are taking a frightful beating, and, in some states, invasions of landowners' properties are not only excessive but all too frequently accompanied by curses, threats of violence and damages. State game departments, not awake to this situation and attempting to set up managed public shooting areas through raises in state license fees, are discovering more and more posted lands and farmers ready to get down behind walls and fences and exchange shots with the gun-goons."

Just imagine if we had thought up "gun-goons", which we wish we had.

When we sent the editor of *Field and Stream* an advance proof of our January editorial about Kristin, the lass with the itching trigger-finger, he replied that he did not regard it as very conciliatory. Yet in it we said, in different words, just about what one of his own editors says in his own magazine. It is all mighty mystifying. However, we are glad to see these frank comments coming from within the gunning fraternity, even if there prevails this attitude of being able to say what you want about your brother, but whaling the tar out of any neighbor who says the same thing. Funny world, isn't it?

ACCORDING to a newspaper story from Gainesville, Florida, 53 deer were released in four of the State's counties by the State Game Commission. This is described as "a part of the State's conservation program aimed at rebuilding the stock which has been rapidly losing ground against the onslaught of hunters." Nature might help if given a chance to operate without competition of the gun.

WRITING in *Sports Afield,* Ira N. Gabrielson, President of the Wildlife Management Institute, does not spare the lash in a survey of the weaknesses of wildlife administration. As former chief of the U. S. Fish and Wildlife Service he had every opportunity to see these failures, and he knows whereof he speaks. "If," Gabe writes, "the standards of all state administrations could be raised to equal those of the half dozen states doing the best job, we would indeed have a potent force for improving the chances of maintaining wildlife populations." This leaves the inference that we have a very long way to go, and it is scarcely reassuring so far as maintaining those populations is concerned.

Partisan and personal politics are assigned an important part in keeping the effectiveness of state wildlife administration at a low level. Sportsmen's pressure, Gabe says, is the second most important factor. While intelligent sportsmen have been responsible for most of the good administration, "and too often for much of the bad," sportsmen's groups are too often ignorant of the facts, "frequently led by silver-tongued but leather-headed leaders who know little more of the needs of wildlife species than what may be learned from looking down a gun barrel or handling a fishing rod." He adds that there is great waste of funds and effort, most commonly due to "pressure for greater and more liberal harvesting privileges than the condition of the stocks will allow."

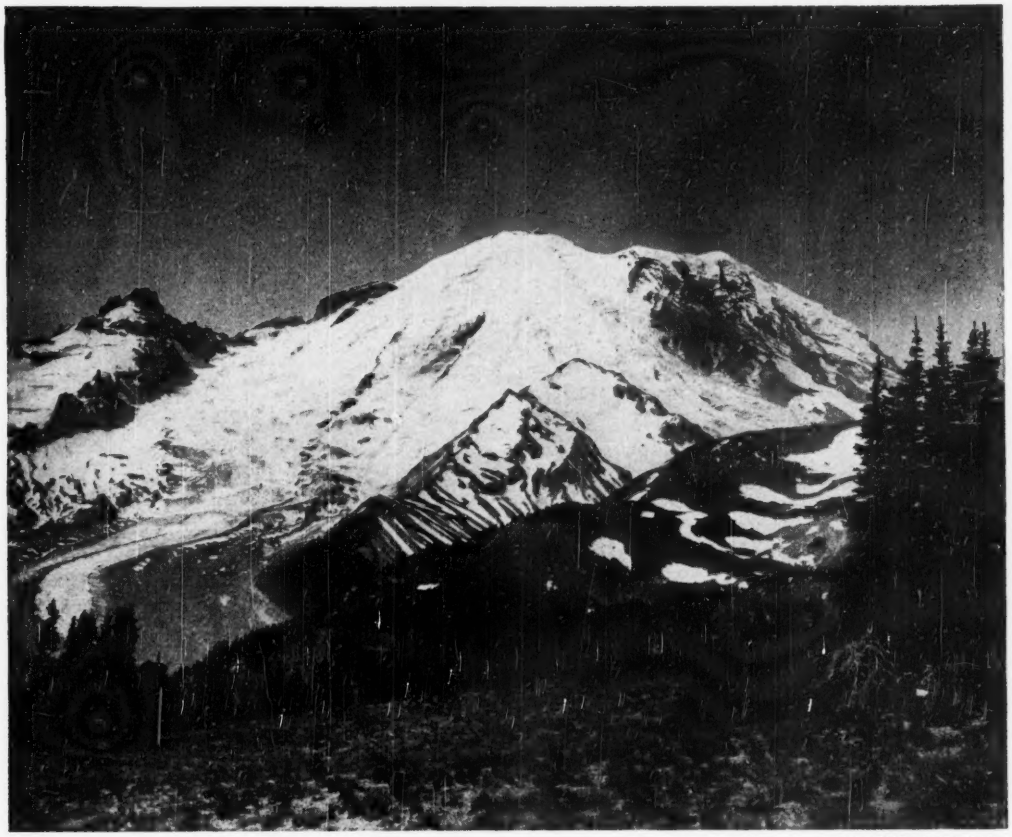
Lack of adequate authority to manage the wildlife harvest is a third important factor. Other factors Gabe cites include inadequate knowledge of game conditions; lack of attention to essentials, such as stream pollution, and public education of *all* the people with respect to the wildlife problem.

Gabe calls upon the intelligent sportsmen to lead in wiping out these defects in state administrative set-ups. It seems to us that this is likewise a responsibility of *all* the people, if we truly mean what we claim—that the wildlife resources are the property of all.

R. W. W.

PHOTOGRAPH BY HILEMAN

Horseback party near Boulder Glacier in Glacier National Park, Montana. If the present warm, dry period continues, the name of this great park may sometime become a misnomer



PHOTOGRAPH BY THE AUTHOR

Forty-five square miles of shining ice fields crown the great bulk of Mount Rainier, Washington. This view of the mountain's east face shows the six-mile-long Emmons Glacier, largest in the United States. At the present rate of glacial shrinkage, Mount Rainier's magnificent ice cap will disappear in 300 years.

Our Vanishing Glaciers

By WELDON F. HEALD

HIGH in the mountains of the West, glaciers are telling a dramatic story that may be of momentous importance to the future of mankind. Silently but steadily, year after year, these diminishing bodies of ice foretell revolutionary changes in climate. If the present trend is long continued, it may wipe out vast agricultural and engineering enterprises, and may even cripple our mechanical civilization.

Our vanishing icefields are warning us that the world is warming up, while, at the same time, temperate regions are probably becoming dryer. Like giant, long-range thermometers, western glaciers have been registering increasingly higher temperatures for the past one hundred years. These natural meteorological instruments, some of them miles long, measure climatic fluctuations in shrinking or expanding ice. Their rapid dwindling in size records a continuous moderation in climate, going on since the middle of the Nineteenth Century.

This is startling news. It deserves headlines along with the latest developments in atomic energy. For a radical change in climate could have far-reaching and disastrous effects on human civilization. If palm trees are destined to grow in New England, deserts advance northwards across the grassy prairies, and the world's 4,300,000 cubic miles of glacier ice melt into the oceans, the United States would be a far different place from what it is today. With a steamy, tropical East, a sterile, arid West, and all coastal cities drowned under 165 feet of sea water, it is probable that our proud "American way-of-life" would be as

Party exploring one of the fifty glaciers in the Sierra Nevada. These ice bodies register changes in climate like giant, long-range thermometers.

PHOTOGRAPH BY THE AUTHOR

extinct as the brontosaurus of prehistoric record.

Such drastic shifts in climate zones have occurred before in the earth's history, and they could happen again. But people who are interested only in present-day affairs need not worry unduly. It might be thousands of years before Eskimos exchange their igloos for bungalows, and boa constrictors hang from trees over the Potomac.

Even minor fluctuations in climate can, however, seriously affect our activities and well-being. Modern civilization is much more closely geared to the weather than most of us realize. There are scientists, notably the late Dr. Ellsworth Huntington of Yale, who go so far as to maintain that climatic environment is perhaps the most powerful factor governing the health, energy, characteristics and inheritance of the human race. Fundamentally, it is weather and environment, they say, that are responsible for the differences between Einstein and the Australian bushman.

Possibly such extreme views are debatable, but there is no question that our complicated mechanical culture is delicately and precariously adjusted to present-day weather conditions. Variation beyond normal limits causes serious breakdowns. Each day our newspapers bristle with lurid reports of human inability to cope with unexpected floods, snows, winds and droughts. Even hot spells take their toll in misery and suffering. In fact, it is rather surprising how narrow are the limits of heat and cold, wetness and dryness within which man can live and thrive.

The complicated machines men live by are even more limited. From Junior's scooter to Hoover Dam, a knowledge of climate is essential to smooth, efficient operation. When you put anti-freeze mixture in your automobile radiator, or use chains during a snowstorm, you are unconsciously propitiating the stern, inexorable weather gods. Both in peace and war, the study of climate is becoming more important. With the increasing use of world airways, the science of meteorology has made colossal strides in recent years. Frontal analysis and other mathematical techniques now give us fairly accurate weather predictions several weeks in advance. And a thorough knowledge of world climates contributed to the successful clothing and equipping of our 10,000,000 troops in World War II, from the tropics to the poles.

But it is not the flash floods, vagrant hurricanes and advancing cold fronts that we have to fear. They are a part of our normal climate, and we take them in our stride. Rather it is the longer variations, lasting for months, or even years, that put our closely integrated civilization in jeopardy.

We can all think of examples. For instance, in the 1930's a series of exceptionally dry years, accompanied by record heat, transformed much of the prosperous, agricultural western plains into a near-desert.

PHOTOGRAPH BY DR. G. W. EVERMANN, COURTESY MAZAMA

PHOTOGRAPH BY KENNETH A. PHILLIPS, COURTESY MAZAMA

Like many smaller ice fields, the Sholes Glacier on Mount McLoughlin in southern Oregon has completely melted away in the past twenty-five years. These comparison pictures were taken from the same spot in 1897 and 1939, showing the disappearance of a great body of glacial ice.

Fifty million acres became the sterile "Dust Bowl," and thousands of people were forced to abandon their ruined farms. Recently, fourteen months of drought brought about a crisis in California. There 9,000,000 inhabitants of one of our most progressive states were faced with an alarming water famine.

These major swings in the climatic seesaw threaten our very existence because they strike crippling blows at our food and water supply. Fortunately, up to now, in the United States, our swings in climate have not been too protracted or too widespread. But, if the warm, dry conditions that caused the Dust Bowl became permanent, the result would be catastrophic. Retreating icefields all over the world seem to be telling us that we may be headed for such a disastrous shift in climate. In fact, the danger signals are up: the rate of glacial melting today is almost twenty percent faster than it was during the unprecedented, hot, dry years of the Dust Bowl.

Therefore, it behooves us to keep a close watch on our glaciers. They are ready-made weather instruments of inestimable value. By observing them each year, and accurately recording the variations in size and volume of ice, glaciologists may eventually be able to tell us whether the present century-old, warm, dry spell is temporary, or whether our costly dams, irrigation and power projects are threatened with a permanent change in climate, with all that means. So far, we cannot make these sweeping predictions. The comparatively youthful science of glaciology has not as yet evolved an exact method for closely relating observed glacial changes with climatic fluctuations. But, with the increasing mass of data collected on glaciers each year, there is every reason to believe that glaciologists may some day be able to foresee future temporary swings in climate, as well as to predict major, world-wide shifts. Such forecasts would extend our weather knowledge into the future, not for months only—or even years—but for centuries.

The intensive study of glaciers should eventually produce definite mathematical formulas leading to these desirable long-range predictions, because moving bodies of ice are the world's most sensitive indicators of climate changes. They register such shifts much more quickly and vividly than do lakes, streams or vegetation. In fact, their very lives depend on a delicate balance between snowfall, temperature, winds and cloudiness, and they wax and wane with the slightest change in any one of these factors.

Glaciers form wherever more snow collects each winter than melts away the following summer. If this favorable climate remains relatively constant, new layers of snow are added year by year, and the accumulated weight compacts the lower portions into crystalline ice. Large masses of ice have the property of "flowing," somewhat as with a viscous fluid such as

molasses or tar. So the entire mass of ice begins to move downhill at rates of a few inches to several feet a day. Eventually a point is reached, at a lower, warmer elevation where the descending ice melts as rapidly as it is replenished from above. Here is the glacial terminal, or "snout."

The terminal will remain at the same place as long as the snowfall at the glacier's head exactly equals the melting at the foot. If conditions become cooler, or the snowfall heavier, the terminal will move down to lower elevations; with a moderation in temperature and a dryer climate the terminal will melt back toward the glacier's head. Since glacier terminals respond to the smallest variations in climate conditions, one can readily see why these great bodies of moving ice resemble huge, long-range thermometers.

Glacier terminals all over the world are now in full retreat—those in our western mountains perhaps fastest of all. Once glistening icefields have diminished to emaciated, shrunken remnants, while many smaller glaciers have completely melted away in the last quarter century. The larger ice streams show startling reductions in size. The great Nisqually Glacier, which flows for five miles down the majestic slopes of Mount Rainier, has lost almost a fifth of its length in ninety years. The terminal of the Blue Glacier in Washington's Olympic National Park has retreated up the mountainside more than a thousand feet since 1933. The volcanic cone of Mount Shasta in California lost fifty percent of its snowcap in twenty-five years, and Glacier National Park may soon be a misnomer, for, at the present rate of melting, there may soon be no active bodies of moving ice left in the Montana Rockies.

Both in the northern and southern hemispheres glaciers are telling the same story of rapid, large-scale climatic changes. From the Alps, Norway, Asia, Alaska, South America and the Antarctic come reports indicating that increasing heat and dryness are everywhere fast reducing the world's 6,000,000 square miles of glacial ice. Even "down under" in New Zealand, glaciers have recently lost enormously in length and volume. In six years some of them have been reduced in thickness from 150 to 200 feet.

But perhaps the most amazing reports come from the Peruvian Andes. There the rapidity of deglaciation is almost unbelievable. Within the memory of local inhabitants, lofty peaks that once bore vast, shining crowns of ice and snow are now completely bare. Dr. J. A. Broggi, Director of the Geological Institute of Peru, has carefully collected data on the glaciers of the Andes. He estimates that the snow line in the mountains of northern Peru has risen 2700 feet in the last sixty years. In terms of temperature alone this would mean that the average is now more than 8° F. higher than it was in 1890! A change of such magnitude in the span of a lifetime is inconceivable, and it is probable that a large part of this phenomenal glacial shrinkage is due to a greatly diminished snowfall. But, in any case, glaciers in the Andes of northern Peru are graphically demonstrating the great shift to warmer and dryer conditions, which are apparently occurring on a world-wide scale.

Recently a meteorologist has confirmed the story told by glaciers. J. B. Kincer, formerly of the United States Weather Bureau, has plotted weather records from all parts of the world. His curves show that temperatures throughout the greater part of the earth have been generally rising since the last decade of the Nineteenth Century. Some of Dr. Kincer's figures date back to the 1850's, and indicate that the climate has been moderating ever since that time. These factual observations exactly check the records of the glaciers and corroborate the fact that we are living in a warm period that has already lasted more than ninety years.

However, even such significant research does not tell the whole story. Glacial ice "thermometers," from Greenland to the Antarctic, reveal that the warming process is speeding up. Almost without exception, glaciers have been melting at a sharply accelerated rate during the past fifteen years. Our own glacier with the longest record of observation is the Nisqually, and it is now retreating four times faster than it was a half-century ago. And, since 1932, most of the world's glaciers have accelerated their shrinkage.

How long will the present warm, dry spell continue? Are we experiencing a temporary swing, or will our great-great-grandchildren live in a markedly different climate than we do today? Nobody knows. But the glaciers will go on quietly telling their story. If our ice "thermometers" reverse themselves and begin a determined advance, glaciologists could announce with some confidence that the century-old "heat-wave" had at last broken. But there are no signs of a change as yet. Rather, the tempo of glacial retreat seems to be getting faster and faster. And, as long as these conditions persist, glaciologists, who study the records written by the ice, say that the weather forecast for the world is—FAIR AND WARMER.

"Breeze in the Loft"

(Bay of Fundy Shore)

By MARTHA BANNING THOMAS

Often the wind pulls clouds across the sky,
And fans them thin and long in streaming hair,
To rake, like witches' locks, along the high
And stainless green which shines above the bare,
Black boulders huddled on the mountain ridge;
Those loftier airs move in a livelier breeze
Up there, and seagulls drift across that bridge
Of buoyant currents, with experienced ease
Almost beyond our seeing. Late tonight,
The tide will turn, and presently we'll know
The weather news from far above the height
Of clouds . . . the wind will tell us, here below!

Maple—The Mystery Tree

By WILLIAM GILMAN

Photographs by Eleanor Gilman

FORTY-FIVE years ago, when Vermont was already noted as the nation's leading producer of maple syrup and sugar, the State's exhibit at the St. Louis Exposition showed the source of nectar for the great American pancake. It also offered a prime riddle to those in the passing crowd who had an interest in Nature's life processes.

To move a typically buxom, living maple from Vermont to the distant "World's Fair" had been dismissed as highly impractical. So a freshly cut, thirty-foot maple log was shipped west by railroad flatcar. In St. Louis, standing in a tub of water, with a traditional sap bucket hanging from the spout inserted into newly bored taphole, the "dead" log—with supreme disdain for precious scientific theories of root pressure, leaf lift, bleeding and osmosis—sucked in water nightly and gave forth sap daily. It performed just as if it were still a live tree provided with roots, boughs and buds.

That exhibit was shown toward the end of a flurry of scientific interest, a half-century ago, in the whys and wherefores of flowing sap. Thereafter, science busied itself largely with other matters. But now, having explored the heavens and the atom, cosmic rays and chromosomes, it is again focussing on our familiar but mysterious friend, the ordinary shade maple.

Science has even found a heroine in the form of a New Hampshire maple, quickly christened "Sweet Sue." For no outward reason at all, nine percent of Sue's sap is sugar. That is three times sweeter than the average for a sugar maple, and it is hoped that ways can be found to populate the Northeast with lots of little Sues, because the ordinary maple tree is falling tragically behind in its economic fight for survival.

Of course, there is sucrose, commonly called sugar, in the sap of all trees. Its presence is a stage in the process whereby leaf chlorophyl converts sunlight, water and carbon dioxide into vegetable "flesh and blood." In my own amateur experiments, I have made sweet but admittedly flavorless syrup from white, yellow and black birch trees; in fact, the power behind birch sap is even greater than that in the maple. Dr. Harvey C. Hayes, a New Hampshire physicist, once recorded a sap pressure of sixty pounds per square inch inside the birch. This, motorists will recognize, is about twice that in an inflated tire.

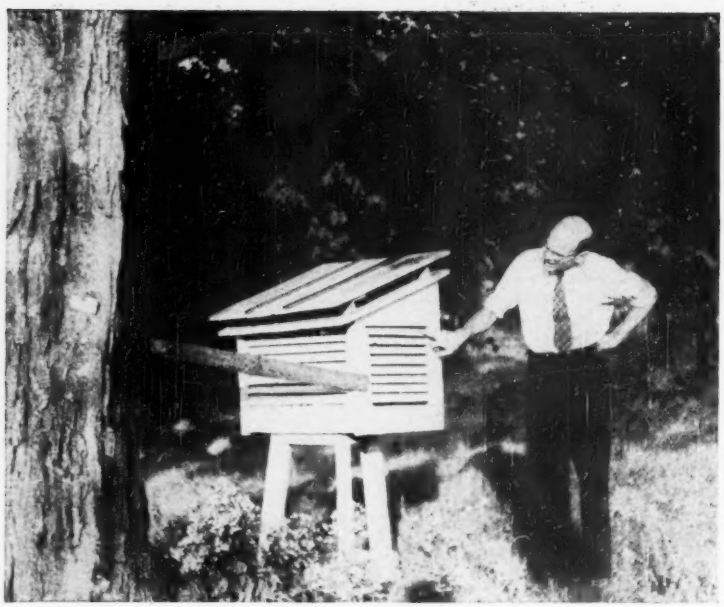
While science seeks to answer some of the riddles of the sugar maple, the Yankee farmer taps the trees in March as he has always done. A tree like this can be "milked" of as many as five buckets, each, in a season, collecting enough sap to produce a quart of syrup. Science hopes to better this.

Aside from the characteristic flavor that makes its concentrated product so tasty, maple sap is distinguished by its leadership in sugar content. This varies from one type of maple to another, and it is *Acer saccharum*, commonly known as the "hard" or "sugar" maple, that is literally the sweetheart of the family.

The "soft" or "red" maple, which is Canada's emblem, is sapped to a lesser extent because its sap is not so sugary. The black maple's sap will generally match the hard maple's, but it grows only in selected localities. There is no such exclusiveness about *saccharum*, which thrives from an imaginary line drawn between North Carolina and Missouri northward and far into Canada.

What makes its sap flow with such stubborn power—and yet so temperamentally, demanding the sunshine of a March or April day after a freezing night? Why is the sap so sweet? And, of most practical importance, how can it be made even sweeter? The answers will help not only those Ph.D.s trying to unriddle the plant kingdom's life processes, but also will rescue a quaint industry badly in need of scientific aid.

The conservationist can well use the maple as an



Dr. Stuart Dunn, plant physiologist at the University of New Hampshire, inspects an instrument shelter recording atmospheric conditions beside "Sweet Sue," the sweetest of all maples yet found. "Sue" provides sap three times the average sweetness.

Exhibit A in his plea that the woodsman spare the tree; that he consider it a crop to be harvested carefully rather than slaughtered recklessly. When other service is over, the tree provides valuable firewood and lumber. Before that, it offers beauty and shade, and fires that heart-warming spectacle, a New England autumn.

The concentrated sap of the sugar maple sweetens pancake and waffle, candies and tobacco—truly a versatile, valuable tree. Yet a combination of factors, most of them economic, is causing an increasing number of impatient farmers to haul their "sugar bushes" away to the sawmill. And around the stumps come up inferior sprouts, which some foresters call "weeds"—the gray birch, poplar, hardhack.

The trend is clear. A few years ago, Vermonters normally tapped five million trees yearly. The number is now down to three million. These trees were mainly inherited, and the new generation, while cutting, is not replacing them. States ranking behind Vermont in syrup production face the same situation.

Maple has long been known to home-makers. Not until recent months, however, have department stores vied with each other in advertising the choice novelty they call "sugar maple" furniture.

Intelligent conservationists know that merely preaching at the farmer is futile. The antidote is as clear as the trend—greater efficiency to make "sugaring" pay. To do this requires harder work, and contains more "hidden costs," than romantic city dwellers realize.

One answer would be maples with higher sugar content. The sugar maple today is exactly as she was when the Indians found her. Maize and tobacco were also Indian discoveries, but agricultural science has enormously magnified their yields. In fact, the maple is unique, agriculturally speaking, in the total lack of genetic improvement it has received. That is why research has begun in the neighboring State universities of Vermont and New Hampshire. The projects are backed by experiment station funds, also by Nature enthusiasts and practical businessmen who do not want their source of maple sugar to dry up.

In Vermont, for instance, former Governor Mortimer Proctor bought a maple-wooded farm four years ago and donated it to the university for a field research center. Others donated sugaring equipment, funds with which to erect a model sugaring house and to employ a research assistant. University of Vermont scientists have promised Mr. Proctor the first gallon of syrup they boil down when they dedicate the sta-

Producing maple syrup for the great American pancake involves boiling down between 30 and 45 drops of sap for every drop of the desired nectar. The ten quarts shown here produce the amount of syrup shown in the pitcher; slightly more than half a pint. Sweeter sap must be developed if the industry is to survive.

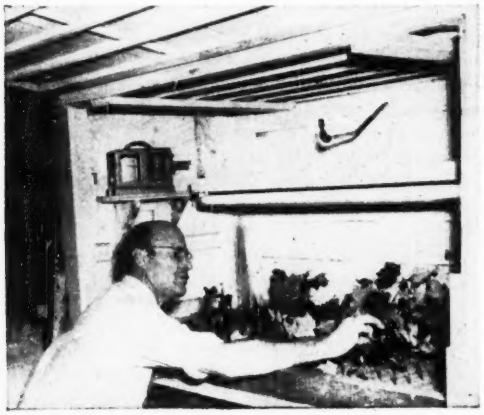
Although it is "sugaring" time in Vermont, these great sugar-producers have been felled for the sawmill. Thus their contribution to the State's industry has gone, and with it beauty, shade and glorious fall color. Note sap stains on the nearest log's butt end.

tion some time this spring.

The boiling will be done in the old-fashioned way. Steaming "sugar house" and bubbling evaporator have not changed much in fifty years. The southern moonshiner, cooking his corn mash, wants the alcohol that comes off in the vapor. The syrup-maker's process is just as primitive but in reverse—he discards the steam and wants what remains in the evaporator.

There were hopes of speeding up the process by boiling in a vacuum. An expert Vermonter tried it four years ago. Results seemed splendid. Boiling went quicker, and at lower temperature. The product had the pale-straw color of fanciest-grade syrup. But it was almost tasteless. The maple "bouquet" was absent. When the liquid was transferred to an ordinary kettle, and underwent slower heating at higher temperature, it turned out to be delicious. The short cut had apparently prevented caramelization, which, along with the sap's native mapleine, is necessary for full flavor. Thus, unless and until better methods develop, syrup-making will remain a tedious process of slowly boiling off between 30 and 45 drops of water for every drop of remaining syrup.

It is in the tree itself, therefore, that the scientists are concentrating their search for greater efficiency.



Armed with refractometers, which instantly record the sugar content in a drop of sap, New Hampshire scientists sought throughout the State for abnormally sweet trees. And they found Sue, the champion, right on their own horticultural farm, just off the university campus.

Was it environment or heredity that made Sue so sweet? They are still trying to decide the answer. If it is environment, Dr. Clark L. Stevens, head of the forestry department, offers a choice of two conjectures, based on the fact that Sue is one of six trees in a row, and all are abnormally sweet. She stands beside what has probably been a barnyard ever since she sprouted, and one of the tests that Dr. Stevens is making with her seedlings will determine the effect of fertilizers upon sap richness. But Sue also stands over a rocky formation, and this revives a long-held theory that sweeter sap is related to stony soil, which reflects more of the sun's heat to warm the tree in spring. The seeds from Sue that Dr. Stevens planted four years ago are now youngsters a foot high, and he plans to start sap tests on them this spring, but warns it is far too early yet to determine whether they will be as sweet as their mother.

Like other maple scientists, Dr. Stevens is handicapped by the nature of his specimen. The maple

Cuttings from "Sweet Sue" are being sprouted in a specially designed propagation bench. Dr. Dunn is thus seeking to produce a sweeter race of maples, using the record sugar output of the mother tree. Rooting is stimulated by fluorescent light, and instruments record humidity in the electrically heated frame.

grows so slowly that a genetics experiment with it can cover the life spans of several men. And Dr. Stuart Dunn, plant physiologist, and the other member of the New Hampshire team, reveal another reason why results must be slow in coming. Maple seeds sprout easily. But such reproduction has limited value for testing purposes. Due to random cross-pollination, the exact parentage of the seedlings is uncertain.

By other means, under which "like begets like," the maple reproduces with difficulty, or not at all. Grafting is touchy, layering useless. Cuttings are the best method, and Sue's lower boughs are robbed yearly for these specimens. But, unlike cuttings from the easily propagated poplar or willow, maples root reluctantly. And then they decline to leaf out the next spring. However, his many disappointments have not discouraged Dr. Dunn, and he is now able to root cuttings fairly easily under white fluorescent light, with high hopes of making them grow after that in humus taken from a maple grove.

The ultimate goal is to give farmers pedigreed maple trees with sap as rich as, or richer than, Sweet Sue's. Then it would be possible to plant sugar orchards whose trees would be as superior to ordinary maples as nursery apple trees are to wild ones.

At the University of Vermont, the research program has two main phases occupying the attention of Dr. James W. Marvin, botany head, and Dr. F. H. Taylor of the same department.

The latter has been propagating seedlings and cuttings in order to build up uniform stocks for comparison purposes. These, and native maples on the experimental farm, will undergo many tests. One tree will be tried with fertilizer, another without; one in a swamp, another uphill, and so on. Obviously, this is only the beginning of a long-term project.

Dr. Marvin is boring into the tree itself to answer the old riddles about sap flow, taking over where the University's chemist, C. H. Jones, left off a half-century ago when science had less research behind it and cruder instruments to work with.

Mr. Jones, now retired, is affectionately called "sugar daddy" by syrup industry and maple scientists. It was in 1897 when he and colleagues began five years of experiments with maples near Burlington. He converted a village hotel room into his laboratory and rushed there nightly with his test samples. He still remembers grimly the "bad years" of 1898 and 1899, when a plague of forest caterpillars nearly ruined his experiments by stripping maples of their leaves.

There were not many questions that Mr. Jones overlooked in his quest. He established techniques by which sap bacteria could be controlled and the quality of syrup thereby improved. To determine the breathing surface of a sample tree, he began calculating and counting. The answer was 162,500 leaves, which, he said, covered "in round figures, a third of an acre."

Using an ordinary steam gauge, he recorded as much as 25 pounds pressure at the tap-hole after noon, and suction during the night when the tree tried to suck back its sap. Everyone "knows" that sap runs up a tree from the roots, but Mr. Jones proved it is not so—at least, during the sugary flow of spring. He recorded twice as much pressure downward as upward. As a matter of fact, he finally concluded it was not really a flow in either direction, but rather an oozing toward the tap-hole. It was not "bleeding"—such as happens with a cut finger—because of injury to the tree. The chemist called it an internal bleeding that went on inside the tree every spring as part of its awakening process after winter's dormancy.

Dr. Marvin has gone in more deeply, exploring his hunch that the flow is caused by intra-cellular changes affected by osmosis and heat variations. By insulating a tree, he has raised its temperature at will, electrically, and made sap flow on order, proving that heat, rather than light, decrees when spring sap will run.

When Mr. Jones sent his log to the St. Louis Exposition he started something more important than was then apparent. In a full-dress experiment four years ago, Dr. Stevens got sap from branches, logs, posts and trees standing upside down in tubs of water. Dr. Marvin has put this freakishness to practical use. He runs sap tests throughout the year, simply by cutting young maples in sugaring season, keeping them in laboratory cold storage and thawing out a stick when he wants to tap in some unheard-of month like July or November.

Now that they can pull such tricks on the matronly maple, scientists foresee a considerable speed-up in their basic research, and the solution of her mysteries may come sooner than they once dared to expect.

★

Debtor

By JEAN ANDERSON

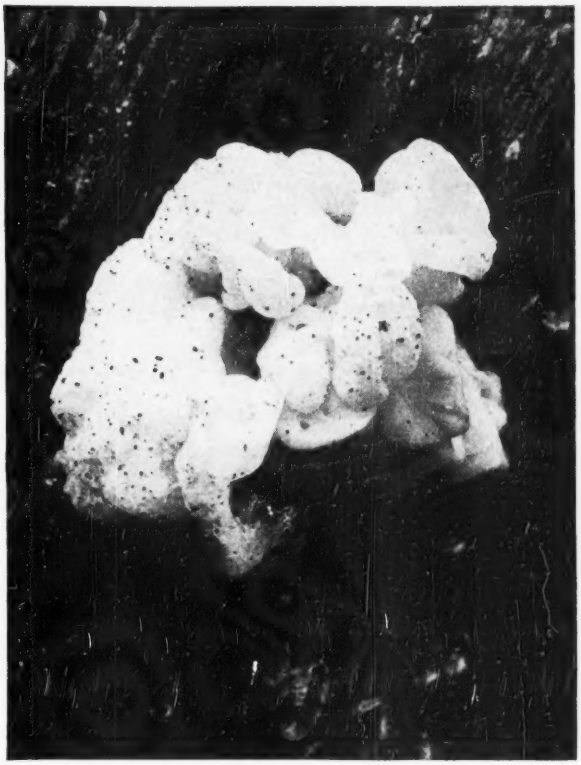
Try as he will,
The artist is in debt
To Nature:
See how she sketches
On that sunlit wall,
The withholding beauty
Of one bare tree
In silhouette.

Life in the Raw

By BLAIR CHAMBERLIN

PICTURE, if you can, a living creature as formless as the raw white of an egg, without eyes, head, feet, legs or mouth, devoid of nerves, muscles or digestive organs yet capable of intelligent movement, able to devour and digest food, produce offspring, and protect itself against destruction!

One of the lesser-known wonders of Nature, this astonishing lump of life, half animal and half vegetable, is one of a small and strange group of creatures that may, some day, help to lift the veil of mystery surrounding the manner in which plant life, eons ago, gave rise to animal life. These real "freaks of nature" have no known practical value to man, but they are of considerable interest to science, and have aroused the curiosity of botanists, biologists and zoologists for many years. One of the comparatively few remaining forms of life that still exist in that mysterious borderland between the plant and animal worlds, their exact place in Nature's plan presents a most fascinating riddle.



A slime mold "plasmodium" consuming fungus on a dead tree trunk.

It seems almost as if Nature, when she finished making all the plants and animals that inhabit the earth, must have scooped up the remaining scraps, tossed them aside and said, as she wiped her hands on her checkered apron, "Well, thank goodness, that job is done." Perhaps those same left-over scraps, still glowing with a spark of life and ambition, oozed cautiously out of the wastebasket, set out to "make something of themselves" and ended up as combination "vegetable-animals" that occupy their own singular niche in Nature's household.

The two scientific names used to designate these bizarre creatures—Mycetozoa, or fungus-animals, and Myxomycetes, or slime-fungi—are indicative of their puzzling place in the category of living things. In the adult stage these odd organisms are nothing more than translucent lumps or sheets of quivering, naked protoplasm, the essential substance of all life. This shapeless mass, flecked with many tiny nuclei, is called a "plasmodium" and looks much like a gigantic amoeba. In moist, dark woods, on old stumps, decaying trees, under bits of bark and dead leaves, these bits of life-in-the-raw are sometimes found in masses large enough to fill a bucket, although usually they are much smaller. Their slimy, soft-soap appearance has given them the common name of "slime molds." Despite their offensive name, these fungus-like creatures are often things of delicate, lacelike beauty and vivid color. Some are brilliant yellow or orange, others are pink, purple, green, or, often, white.

Close inspection reveals that this creeping creature is not a single individual but a colony, or swarm, of hundreds of pulsing, weaving bits of life all fused into one mass that moves with a constant sluggish motion: a primitive rhythm that is stronger in one direction than in the other. By this strange rhythm the mass moves along on its barely perceptible but purposeful journey, reaching out with portions of its glutinous body to grope about like some blind monster in miniature.

Without any cell structure, and without chlorophyll, the slime molds cannot manufacture their own food in the manner of plants, so they live on bits of bark, dead leaves and wood. Some species, even more animal-like than others, devour bacteria and fungus, and will often turn aside from their sluggish course to flow around and envelop some choice tidbit.

While in the adult stage, these "creatures" also exhibit their instinct of self-preservation by avoiding light, and attempting to conceal themselves by creeping beneath leaves and bark, or streaming into cracks and crevices of old logs and stumps. Like the legend-

ary glass snake that was supposed to break into pieces and scatter in all directions when alarmed, and then rejoin itself and wriggle off in safety, the slime mold actually does possess the uncanny ability to separate into fragments and then fuse together again in a single mass. This amazing fact was demonstrated by forcing a slime mold "plasmodium" to pass through a piece of wet wool. In order to do so the creature had to separate into pieces small enough to go through the tiny openings in the material that barred its way. As soon as these minute particles emerged on the other side they immediately flowed together again into a single mass and then continued their interrupted journey.

How does this unprotected sheet of naked protoplasm manage to exist in dry weather? Nature has provided for just such an emergency by giving the slime mold the ability to harden its outer surface and form itself into a great number of hollow sacs or pockets, each of which contains and protects a small mass of protoplasm along with its own nuclei. Under observation these dehydrated fungus animals have been known to live for as long as three years, and when moistened at the end of that time, the hard, dry, outer shell dissolved and the creature again resumed its former jelly-like form and continued its weird, creeping life where it had left off, apparently unaffected by its inactivity.

Perhaps the most remarkable thing about these fungus creatures is the manner in which they carry on their reproductive process. Suddenly, and by some primeval instinct, they seek out a lighter, more exposed location, and, as the entire mass begins to shrink and harden, the army of tiny creatures that make up the "plasmodium" work in closely coordinated groups and begin to gather in clusters that form wart-like knobs, which keep extending upward until they form a stalk or stem. As the stalk is being formed, a tiny fleck of naked protoplasm climbs up the stem like Jack climbing the beanstalk. Once atop this stem, the protoplasm begins to harden, and, almost as if by magic, changes itself into a tiny, complicated structure known as the "sporogonium," or spore factory, wherein are manufactured the minute, dust-like spores. This whole amazing process often takes place within the space of a single night, and seems almost to smack of the supernatural. It is as if a lump of bread dough were suddenly to change itself into some complicated device like a watch. One moment the slime mold is merely a sluggishly moving lump of jelly, blindly groping its way along in search of food. A few hours later the entire mass has disappeared and in its place is a tiny fairy forest of exotic-looking plant-like sporangia, each one so small one needs a strong hand lens, and sometimes a low-power microscope, to see them in detail. Many of the spore-bearing structures are fantastic and marvelous in design and things of intricate beauty. Some have stems, others have none; some grow in clusters, others singly. Some are like tiny ostrich plumes, others look like tiny ears, minute cups or saucers; some are biscuit-like in shape, and many others look like diminutive trees. There are hundreds of species of slime molds and no two produce similar spore-bearing organs.

Once the spores are fully developed within the spore-cases, these odd devices have the ability to respond to the humidity of the atmosphere and only release their spores when conditions are most favorable for their sowing and germination. For example, the spore-bearing structure of one species (*Stemonitis*) consists of a stem from which grows a web-like mass of fine threads, and tangled in these threads are the many tiny spores. When the time is ripe to sow the spores this veil is torn apart and so releases its cloud of spores to be distributed by the wind. Any of the spores fortunate enough to alight in a moist location soon begin to swell until they break open and hatch out a tiny creature that creeps from out the hard spore case like an egg streaming out of its shell. This minute bit of life is oval in shape and temporarily possesses a whip-like tail that enables it to swim or creep about. This tail soon disappears, and the creature takes on the appearance of a tiny fleck of protoplasm known as a "myxamoeba," which soon begins to multiply by division so that one individual becomes two. Once this stage of the reproductive process is completed the individuals begin to fuse together in pairs. These couples join others, and, like drops of quicksilver, run together until they at last form the jellylike mass of protoplasm called the "plasmodium."

To investigate the private life of a slime mold (Mycetozoa) is to marvel at the unending originality of Nature. This slippery (Continued on page 144)

In Blues and Greens

By KENTON KILMER

For blue on green and green on blue
Look how through spreading green of leaves
Gleam the blue shards of sky.
Watch the smooth emerald slope of lawn
Circling the sapphire pool.
The trick's to take them boldly, make them strong,
And shine the sun full on them.

Green and blue—why they're a king's crown jewels!
They're the saints' robes in the cathedral windows,
Bright with broiders of gold and crimson facings.
Not wool-and-cotton muddy, but the clear shine
Of satin, or color velvet-deep.
Take hard enamel color, baked to glassiness,
Or streaks of apple green in cloud-blue dusk.
Let them show true and clear against each other,
Or swirl them in together, as God did
When He made peacocks!

The brown shrew photographed by the author is Saskatchewan. These widely distributed, restless little animals are among the most interesting small prairie mammals.

The Brown Shrew

By H. H. PITTMAN

Photographs © by the Author

THE widely distributed, restless little shrews are among the most interesting of the smaller prairie mammals. They belong to a group of animals known as the Insectivora; an order which, for present purposes, includes the shrews and moles. Feeding largely upon insect larvae on the ground, they may be said to complement the work of the bats, which prey upon the adult forms in the air. In southern Saskatchewan the common form is the brown shrew, *Sorex cinereus*, which, although not plentiful, is well known to all owners of shallow wells.

The shrews are small and mouse-like in appearance, and, when examined, show several interesting peculiarities of structure. The absence of a gap between the incisor and molar teeth distinguishes them from some small rodents, which they superficially resemble. Their skulls differ from those of most of the small mammals because of their incomplete zygomatic arches, those rings of bone that normally form the lower edges of the eye-sockets.

The eyes of all our shrews are so small that they can readily be held in place by muscle and tissue alone, without the support and protection of bony rings. Although their eyes are smaller than those of some of our butterflies, shrews are not blind, but the position and size of the eyes suggest that sight may be of less importance than some of the other senses. It is not surprising to find that their brains indicate an unusually well-developed sense of smell, and their long, sensitive noses are so well supplied with delicate bristles that it seems probable the senses of smell and touch take the place of sight to some extent.

Although these shrews are found everywhere on the plains, they seem more partial to the uplands than to low-lying land. Because of their small size and the dense vegetation, these little animals are inconspicuous and may be more plentiful than a cursory examination indicates. They are so very mouse-like when met with in the open that they are often supposed to be immature specimens of mice. Their gait is rapid, and the movements of their legs so quick that they seem to glide along rather than run, making the movements of mice seem almost jerky in comparison. However, there is an interesting difference between the shrews and the mice. The latter are excellent gymnasts as a family, and some species seek food and even make nests well above ground-level at times, but the shrews seem quite unable to climb. They will go up a gently sloping tree trunk, perhaps, or upon a half-buried boulder, but that is all.

Brown shrews are burrowing animals, but so readily use the tunnels left by mice that it is generally difficult to determine the extent of their own work. Occasionally we find their runways are so shallow that the tops make little ridges on the surface. These, perhaps, are made as the animals search for insect larvae among the grass roots, for they are always hungry. Their voracious appetites seem to goad them to incessant activity, and, as their digestion is rapid, their lives appear to be little more than a continual quest for food.

Such small and elusive animals are hard to study in the field, and there may be more in their lives than we think. I write this because I once saw a gathering of the allied black shrews, in central Alberta, which was hard to account for. While searching for a snipe's nest, I saw and heard twenty or more of these short-tailed little animals milling around a tussock of grass in great excitement and nearly all of them squeaking. I cannot recall ever seeing more than one brown shrew at a time. In captivity it is difficult to keep several together, and often disastrous to put them in a cage with other small animals.

It has been suggested that our shrews may be an-

Brown shrews are active throughout the winter in the great part of the prairie country. The thermometer registered eight degrees below zero on the day that the author snapped the photograph of this specimen.

nuals, only the young ones of the year living through the winter to the next year. Considering the restless energy pent up in their tiny bodies, this idea seems reasonable, for fierce fires burn out quickly. In England the number of dead shrews found in autumn in open spaces beside roads and paths appears to support this theory, at least with European species. Of course, the dead animals were more noticeable among the shorter vegetation bordering footpaths than in the surrounding undergrowth, so the belief arose in places that it was fatal for these strange little creatures to cross a path!

Shrew nests are small balls of grass and leaves in burrows, under stumps and logs, where these occur, or in a natural cavity that has been altered and adapted by the animals. Sometimes they are under an overhanging bank, or in a pile of stones, but, as far as I know, they are discovered only accidentally long after the owners have left them. It is said that litters of six or eight young ones are the rule. I have never seen young shrews at the age when they are about ready to leave the nest and play, but imagine they would be most curious little things with their absurdly long noses. In Saskatchewan it is probable that two litters are raised every year, possibly more, for small animals mature quickly.

The shrews' sole protective devices are their small size, combined with quickness of movement, their neutral coloration and the possession of scent glands. These glands secrete a musky odor, which seems objectionable to everything but owls. Their survival is perhaps due chiefly to the fact that they are very small. Being practically helpless, their inconspicuousness promotes longevity, and these animals can thread their way in and out among the forest of grass stems clothing the prairie without causing a ripple.

The fur of the shrews, like that of the true moles, is peculiarly soft and silky, and can be brushed either way with an equally pleasing effect. It has been stated that this is because the roots of the individual hairs grow upright in the skin instead of at an angle from front to back like those of most mammals. However, the real reason seems to be due to the fact that each hair consists of alternate thick and thin portions, which permit it to lean freely in any direction and give the skin a velvety surface.

Looking back into the ancient past, we find the first shrews appearing in the Miocene deposits, where their remains are recognizable but scarce. The most remarkable thing is that they seem to have changed so little during the ages. Their size and shape apparently must be as close to the ideal as those of any present-day creatures, for they have withstood the test of time. So, although man has been in existence for rather less than a million years, the shrews go back to a period that ended some fifteen million years ago! While so many powerful and aggressive creatures disappeared, the harmless and humble shrews survived the change.

★

Beetle in a Collector's Jar

By DORIS V. SMILEY

Doughty knight in ebon armor
Blazoned with a bar of gold,
Banished from green field and arbor,
Through with daring deeds and bold,—
Here you languish, lost and lonely,
Captive in a crystal tower
Far from blossomed elderberry
And the plum's ambrosial bower.
All may now behold your beauty
(By its own bright badge betrayed!)
Science has performed its duty:
Labeled, classified, displayed
Tidily within your tomb,
Yours a swift and certain doom.

Profile of a Hawk

By MAE HALLIDAY

Photographs by Hugh M. Halliday

An early June sun was just breaking over the horizon when we parked our car. Burdened with cameras, field glasses, climbing equipment and other paraphernalia, we crossed a wide, rolling, dewy field. Then, following a shrubby valley, we came to a wood of towering maples and beeches. In one of these trees a red-shouldered hawk's nest had been under observation since before the parents commenced lining the nest with evergreen twigs. The young had now been hatched at least ten days. We were planning to erect our collapsible blind and, while sitting within, watch the dramatics of the young and their parents.

On the ground below the nest tree lay three emaciated hawklets, dead. Hugh, my husband, is one who never gets excited over such a catastrophe, so I expected him to philosophize about the mortality among birds. But there was something personal about this particular nest, close to home and frequently visited. And it seemed plain that the parents had been shot, and three of the four starving young had fallen from the nest.

Tight-lipped, this time, Hugh strapped on his climbing irons and started up the tree. It was a climb of some seventy feet of straight, limbless trunk. The climber was at the nest, peering in, then, as he descended, I heard a lusty peeping. On ground again, Hugh reached into his shirt-front and drew forth a hawklet, putting it down. Swinging around in a half-circle, the bird dropped back on its fluffy tail-end in a saucy, "I am not afraid of you" attitude. Its large, keen, searching, grayish eyes looked out from a soft, down-covered head. Placing the orphan in a paper bag, we brought it home.

In spite of its original fighting attitude, the hawklet tamed almost immediately. After the first piece of sirloin steak, it seemed to think that I was its mother. And what a meal that half-starved little creature put away!

Hugh suggested that the hawklet was a female. It seems that the females, as a rule, are more spirited than the males, and he believed the orphan answered female requirements. Being a woman, I heartily agreed. We named her Wagtail, for reasons that will be obvious.

For more than a week the bird's new home was a large cardboard box, kept indoors. Although hand-fed at first, she soon learned to feed herself. Soon afterward a young marsh hawk, which we named Reddy, turned up.

Wagtail was good natured and friendly; Reddy was silent and distrustful. Wagtail would peer and peep into Reddy's face as if trying to engage in conversation. Then she would run her bill down his wings and over his head and neck. Reddy accepted these attentions silently, but seemed to like them.

If we took Reddy away, Wagtail immediately went hunting and calling about. When he was discovered, the little red-shoulder would rush to him and peep and peep into his face until the whole sad story was told.

As evening approached Wagtail wanted to go to bed, but Reddy was never sleepy quite so soon.

Wagtail in the paper bag in which the orphan was borne home from her parentless nest.

Finally, after a lot of persuasion from Wagtail, he would settle down on the bottom of the box. Then Wagtail would put her head right in the middle of Reddy's back and go sound asleep.

When allowed the freedom of the garden, Wagtail ran about until tired. After a short rest among the shrubs, she was at it again. When she learned that she had wings she fanned them vigorously. This raised her off her feet. Each day she went higher, and her progress forward resembled a sort of crazy hop, skip and jump.

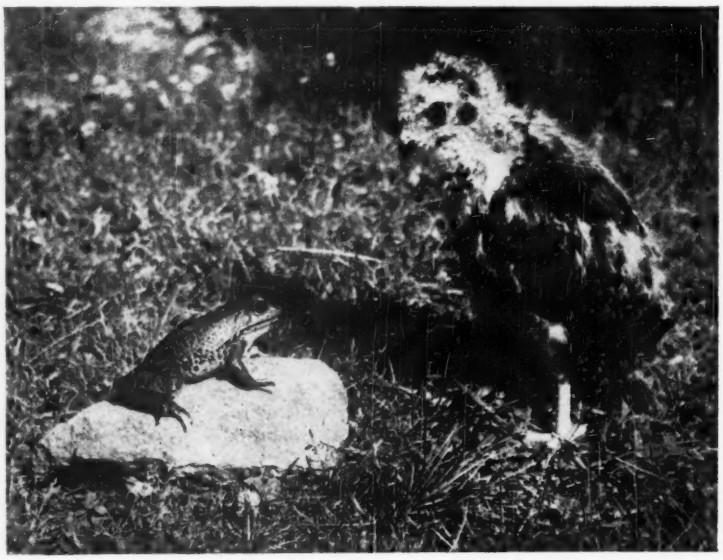
Wagtail loved to play with sticks and stones. Sneaking up on them, she suddenly seized them with her talons. Then, after fondling them with her bill, she carried them off in her claws to an old stump, which was littered with the things she had collected around the garden. She became very fond of playing with a rubber ball. As she walked with it clutched in her talons she resembled an old man on crutches.

Although the hawk loved it, bathing was a serious business, almost a ritual. After taking a drink, she carefully, almost furtively, stepped into the bath. After standing still for a few moments she commenced to bob up and down, but always avoided splashing water on her head and back. Clean feet were a mania with her, so, after shaking herself she stepped back into the water—often several times—before proceeding to her stump and prettily spreading her wings and tail full in the sun.

She observed everything, from tiny insects on the ground to airplanes and birds overhead. When I talked to her she had a way of turning her head to one side in a kind of questioning or understanding attitude.

As Wagtail grew she lost her cute, downy "fancy pants." She feathered out, and her baby "peep" changed to a "gazook." Her head was graced with a crest, which, when she became alarmed, she raised, then shook herself vigorously and puffed out her feathers until she appeared twice her normal size. She grew to be a large, powerful bird.

I never knew Wagtail to be afraid. When she struck a threatening pose, no strange dog or cat dared come



The red-shoulder inspects a new acquaintance. Frogs, in fact, were her second choice for food.

Wagtail and the author go out for a ride. When talked to, the bird always had an attentive pose.

near. Previously we had been pestered by eight or nine tomcats; now they shunned the neighborhood. That is, all but one old, battle-scarred Tommy, with fat jowls and torn ear. He dared to climb on the roof of Wagtail's flight cage. From her perch she stared hard at the bold fellow. The cat, in a crouched position, stared back. He started creeping across the wire mesh. Suddenly there was a flash of wings and talons. As Wagtail swooped upward she turned on her back in the air. With talons thrust forward, she struck at the cat's underside. He shot into the air, his feet hardly touching the ground as he bounded away from such silent and sudden fury. Only the wire netting saved him.

Wagtail's attitude toward our terrier was quite the reverse. He belonged to the premises, and, obviously, she liked him. Turning her head sidewise, she made little "talking" sounds as he went in and out of her aviary, smelling around for left-over scraps. House sparrows, too, were never molested. Wagtail just looked at them as if their affairs were none of her business and she did not regard them as prey.

One day our red-shoulder was just starting to bob up and down in her bath when Reddy, the marsh hawk, also decided to bathe. He grabbed her by the tail-feathers and commenced tugging. Wagtail's strength was several times that of the marsh hawk's, yet she good-naturedly gave in to him every time. But, when he was not looking, she would steal his victuals.

When hungry, Wagtail always covered her food by drooping her wings, bringing her tail in under her, and turning her back toward spectators. She was like a dog with a bone. If I walked slowly around her, she kept turning so that her back was always toward me.

Fast and clever as was Wagtail's footwork, her strength seemed even more remarkable. Frequently she would grasp a sponge-rubber ball in her talons and squeeze it almost into nothing. When she put on the pressure her legs stretched straight out, while she supported herself with her wings and tail. A weasel, for instance, would be power-

The hawk was fascinated by the spray of the garden hose and loved to play in it until thoroughly wet.

less within such a grasp, and, indeed, lifeless within a few seconds. Wagtail's talons were like razor blades.

She loved, on warm summer days, to get into the spray from the garden hose. When she saw me bringing out the hose she filled the air with her loud gazooks, coupled with much hopping about. As the spray fell on her she raised and flapped her wings and turned around and around, all the time calling "gazook, gazook." When she had had enough she stepped from under the spray and spread herself out in the sun to dry.

The bird's tail operated much like the pendulum of a grandfather's clock. When she had eaten, or when I talked to her, she sat straight up and wagged her tail from side to side. Sometimes this was accomplished by the stretching of one leg and then the other, straight out in front as if she were preparing to do a Russian dance.

Toward November, I was awakened one morning by a wild, piercing call of "Cree, cree, cree." Wagtail had discovered that she could talk real hawk language. Since then, I thrill to the call of one of these big buteos—wild, clear, ringing, and exultant. It evidently is a manifestation of high spirits and a feeling of kinship with air and space.

Snakes were Wagtail's favorite food, and it was with a snake in her talons that the bird was last seen.

Wagtail's preferred food was snakes, frogs next, then meadow mice. Feathered food she refused entirely. Throughout the winter, since this was the best food available, we fed her lean beef dipped in cod liver oil.

With her natural prey, such as snakes and mice, the hawk quickly disposed of the head. Then, as she seemed in no hurry to continue her repast, I imagined that she said to herself: "There now, the business end of this thing is taken care of and I can eat in peace."

Once a screech owl that had been shot was brought to us. I skinned it and offered Wagtail some of the lean meat. She moved as far from it as possible, and seemed insulted.

As the temperature dropped I become anxious whether the bird's feet would get frost-bitten. On the first cold night, however, she knew exactly what to do. Raising herself up, she fluffed out her feathers, then slowly lowered her body over her feet.

Late in the winter she began to molt. First small feathers from her breast and underparts fell out. Then she shed her tail and wing feathers, but the process was extremely slow. She was never minus more than two feathers in a wing or in her tail at one time. She was busy all day preening, using her beak to pick the skin away from around the sprouting feathers.

As spring arrived, Wagtail spent much of her time peering into the distance. Objects beyond the range of human vision seemed to attract her. As a migrating hawk passed overhead her heart seemed to go with it to its more northerly nesting destination.

During the winter, Wagtail was kept in a large flight cage. This was considered necessary because she had had no experience in hunting her own food. As soon as her natural food was plentiful we left open the aviary door. She made no effort to leave. The aviary was her home, and the migrating instinct, which might have prevailed earlier in the season, seemed to have disappeared.

One morning, however, Wagtail was perched in a nearby tree and, when I fed her, she carried her beef to the rear of the garden. Later in the day a youngster called with the news that our hawk was in a tree over on the next street, and that boys were throwing things at her.

I found the bird surrounded by a gathering of curious persons. As I walked under the tree and spoke, she immediately raised her crest, and, as the spectators moved off to one side, flew down to a fence. After talking to her for a short time I picked her up and carried her home.

Few birds submit to handling, but Wagtail made only a feeble effort to free her wings. Back in the aviary she flew to her perch, flapped her wings, and set about preening her feathers.

The following week we drove twenty-five miles to a wild, wooded expanse of rough country where snakes abound. For possible future identification, we banded Wagtail, then placed her in a large paper carton and took her along. At the edge of the wood we put the carton on the ground and removed the cover.

For nearly half an hour Wagtail appeared completely uninterested. Suddenly her head shot up. Her eyes flashed. She became as a bird inspired.

When aware of her new surroundings she evidently had caught something of that spirit that dominates her noble race. Her wings flapped and she flew to a branch one hundred feet away. As she turned her eyes in every direction, her (Continued on page 144)

Is Ice Nice?

Another educational feature in the new series

By E. LAURENCE PALMER

PHOTOGRAPH FROM BRADFORD WASHBURN

Rivers of ice that form into a glacier, within the embrace of mountain peaks, have a great influence upon the way of life in many regions.

LAST month, we gave you the opportunity of studying snow and snowflakes. Before the season gets too advanced, it might be well to give some thought to the ice that is with many of us during the winter months. Has it been a blessing, or does it provide hazards?

Ice gets often into the news at this time of year. We hear of wagers on the exact time the ice goes out of an Alaskan river, but few of us keep any record, or have any comparable data, as to when the ice goes out of our local streams. The newspapers show us pictures of specially equipped steamers that break their way through ice-clogged lakes to clear the way on such waterways as our Great Lakes. Few years pass without news of fishermen, or youngsters, getting caught on floating masses of ice and drifting down turbulent streams, or into storm-tossed lakes, to their death or to fame as a result of some sort of heroic rescue. Skaters and ice-boaters frequently either face or meet death because of their inability or unwillingness to understand and respect the variations that take place in the ice that forms the basis of their sport. Much of a local wildlife population may be wiped out by an ice storm, or the prosperity of hundreds of fruit growers may be ruined by unexpected or unusual conditions causing the formation of ice, where it may be detrimental, or causing protective ice mantles to vanish before the season's weather may have become settled.

These are a few of many aspects of ice that should interest naturalists generally, whether their concern is largely with things biological, or with the field of physical science. Ice is no respecter of the writer of a school curriculum. It affects geology, may be conceived in meteorology, is ruled by physics, may be influenced by chemistry, and makes or breaks the best laid plans of all living organisms. The dictionary tells us that ice is water frozen or reduced to the solid state by cold, that it is transparent, and a nearly colorless, crystalline and brittle substance. We are told that when water freezes it expands about 1/11 of its volume, and that its specific gravity is roughly .9 that of water at 4° C. We are to understand that pure water freezes at 32° F. or 0° C., and that ice melts at that same temperature. We are further advised that, mineralogically speaking, ice "belongs to the hexagonal system." Armed with these facts, some of which we may accept with slight reservation, we can go on with our subject and find if ice does not have some other attributes that may be fully as interesting.

Our February article in this series dealt with snow, a form of ice. There we saw samples of the variations that occur in these crystals, but what we learned from the article, and I am sure from subsequent observation of snow, confirmed the statement of the physicist that ice "belongs to the hexagonal system." We found no 4-pointed or 5-pointed snow crystals, and may be surprised to learn that some persons have the idea that snow in Florida has a 4-pointed crystal while that of the middle-West has a 5-pointed crystal. One reader of these articles wrote in to ask if there was any truth to that belief. I rather think I can leave it to your own powers of observation to settle the issue.

As youngsters most of us come to know ice through its relationship to skating and to coasting. We may have explored an icicle with our tongues on a bitter cold day, and regretted the experience for a long while after. We may have skated over clear, rubbery ice on ponds and slow rivers, and seen turtles and

muskrats swimming beneath, perfectly protected from us. We may have cut a hole in a plant-clogged pond and found the open water crowded immediately with fish seeking oxygen that they could not get in the water in which they had heretofore spent their lives. We may even have seen fishes crowded out on the ice at these airholes. Again we may have seen great cakes of ice heaved out of water in the spring break-up and discovered pickerel and other fish in it. Few youngsters who have been reared near a body of water have managed to grow to adulthood without at least once having tempted fate to the extent of breaking through thin or rotten ice, with most uncomfortable and possibly frightening results. Some of us, reared in the days before mechanical refrigeration was so universally accepted, can remember the farm chores associated with filling the icehouse in winter and packing the cakes in new, fresh sawdust. All the while these perfectly obvious experiences with ice were taking place, equally significant but less conspicuous influences were having their effect on things on every hand.

On the day on which this is written I stood on a bridge over a swiftly flowing stream. Last summer, I used to stand on this same bridge watching small-mouthed bass below. In the preceding spring, I had watched schools of suckers make their way upstream to the bridge from the lake below. Today I saw no fish in the ice-bound water, but there were patches of ice fast to the bottom as anchor ice, and the rocks on the stream bed abounded in waving masses of water plants and were slippery with plant materials. What changes may I expect, due to ice, in the next few weeks and before this article appears in print? Will the stream still be crystal clear? Will the bass and suckers have made their appearance? Will the plants have vanished? Check me with some local stream and I think you will find that the most remarkable change will be associated with the apparent vanishing of the plants. These will have been scoured free from their rocky support by small and large pieces of ice that are carried downstream in the rushing water. This will mean that much food that might have been available for the animals of the stream will have vanished. It will also mean that there is new, fresh territory that may be occupied by new, and possibly more vigorous, species of plants.

Icicles provide an interesting study. How do they form? Are they as brittle as reported? What can you learn of their history?

The anchor ice at the bottom of my stream was formed during a period when we had sustained bitter weather. The water, brought to a point close to or below freezing, could not form solid sheets of ice at the surface because of the necessary movement. Close to the bottom, however, where movement was slowed by stones and other submerged objects, ice could form. And this ice mass could and did grow by taking to it other ice brought by the flowing stream. In some cases, the buoyancy of this ice, or the force of the stream, was sufficient to break the mass loose from the bottom, permitting it to be borne downstream, where it bumped and tore at everything with which it came into contact, and generally changed the nature of the territory through which it moved. When it broke loose from the bottom, the chances are good that it carried with it some smaller stones or other materials, and left unprotected insects, crayfish and other animals that had formerly been safely "holed in" for the winter period. The ice had set their whole world topsy turvy, and, of course, many of them were unable to survive the new conditions they were compelled to face. This removed them from competition with their fellows who might have happened to seek shelter under stones that were not moved by the ice.

This scouring effect of ice in the stream near my home has had its effect on the shape of the stream-bed itself. While today the water was clear and relatively free from moving ice, I know from past years' experience that, when the scouring is begun in earnest, my stream will become muddied by the loose earthy material that will be broken loose, in part by this icy stuff. Then, I will not be able to see the bottom at points where now it is plainly visible. This muddy stuff, of course, shows me that earth is being moved, and while it is gone from one place it will come to rest at another. Eventually, this shifting will become significant and the ice will have played its part in the change.

If I follow my brook to the foot of the hill, where it reaches a lake, I can find ice apparently causing other changes than those we have mentioned. With the spring freshets bringing down great chunks of ice weighing hundreds of pounds, the piers in front of my boathouse take a real punishment. Piles that may not have been set firmly, but whose tops may have

been frozen into the ice, may be lifted bodily from their position because of the unusual strains to which they are subject. Other structures, such as docks and foundations of buildings, may be damaged by the ice masses, which may move about because of currents or winds. This is most important to property owners, and, unless the lake level is properly maintained, real havoc may result.

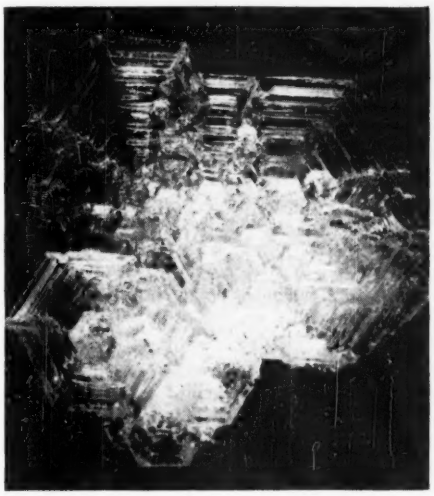
Earlier in the winter, the ice in my lake or along a stream may cause some damage because of that little note we found in the dictionary telling us that when water freezes it expands about 1/11 of its volume. If this means that a pond eleven feet across will be forced to occupy a twelve-foot span, then, of course, trouble will result. I took this into consideration when I made my small lily pond. Instead of building the sides so that they are vertical, I built them so that they have a pronounced slope. Because of this, the water in my pond can freeze and expand, but the walls of my pool will not be pushed apart, causing a leak. With this arrangement, I can leave water in my pool through the winter, while some of my neighbors, with straight-walled ponds, find it necessary to drain theirs each winter or to repair them each spring. It pays me to know what ice will do to a lily pond if I have to keep it in repair.

I hope that you will not take my word on all of these matters, but will try to check up on me. When some pond is beginning to freeze, drive a few stakes into the ice at different points. Measure the distance between the stakes to see if they change as the cold weather continues, or as the pond becomes more completely frozen. Similarly, drive a few stakes in a straight line across an ice mass and notice if they stay in line. Agassiz, years ago, tried this on a glacier in Switzerland and was surprised at the result. You may be surprised at the simple changes that may take place in some ice in your neighborhood.

The ice that covers your neighborhood pond may well influence the prosperity of your community. In the North we read much of the success farmers in the South are having with farm fishponds. Some have thought that anything they can do in Georgia and Alabama can surely be done in New York and in Ohio. But there is one difference that has not always been recognized in the problem of pond management in these two areas. In the South, the winters are relatively short. In the North, they may be long. Southern ponds that may have a skim of ice, or may freeze over for only a short time, are quite different biologically from northern ponds, where the water may be covered for months by a thick coating of ice, and where this ice may, in turn, be covered by a thick layer of snow through which little light may pass. Pond management in the North will undoubtedly be developed to a point where it may be successful, but, if it is, the plan will call for recognition of some of these differences we have just mentioned. It is absurd to try identical techniques of management where there is great divergence in the factors being managed.

PHOTOGRAPH BY EDNA H. EVANS

An ice storm in Louisiana. Such storms are terrifically destructive of trees and leave their marks for many years.



The geometry of ice crystals introduces the study of this phase of ice into the class on mathematics.

So far we have confined our emphasis in the study of ice largely to seeing what it does when closely associated with bodies of water like lakes or streams. We could continue calling attention to the influence of warm springs that thin an ice covering from beneath, sometimes to the misfortune of those who skate over such spots. We could elaborate on the fate of those fishes that we saw frozen in the ice, or on the ways in which ice carves the earth. We could call attention to the way the ice in gorges and near waterfalls freezes to and into

rocks and then "plucks" these rocks free from their former position, thus changing the shape of the adjacent land. If we did elaborate on these things we would, unfortunately, have to omit some other equally interesting things that probably may be more easily observed by a greater number of readers.

When ice forms independently of standing or moving bodies of water, it may affect greatly the things with which it comes in contact. At this time of the year, we may have a few days of really cold weather that may mark what we call "the last stand of winter." Under conditions such as these, the earth, trees, telephone wires, fences and other things sticking up into the air become thoroughly chilled. If, about this time, a mass of warmer, moisture-laden air moves in, this moisture may become frozen when it comes in contact with the colder substances. It is quite possible that this process may continue for a long time, during which the weight of the ice will be constantly increasing. Twigs and branches of trees will become heavily ice-coated. From the telephone wires will hang rows of icicles, or the wires will be enclosed in great ice cylinders. The weight of this ice will put undue strain on the supporting structures, and all sorts of unfortunate things may happen. A few years ago an ice storm such as this came to my home town. Now, years later, you can still see the effect it had on campus elms and on some of the trees in my woodlot. The night of the storm I was awakened by the crashing sound of huge branches being torn from the trees. I went outside to find a white cedar hedge and a row of white birches almost flat on the ground. A neighbor's driveway was completely blocked by young elms that had been bent almost to the ground. Cautiously, I attempted to knock the ice from my Japanese maples only to find that in so doing I broke the trees as well as the ice. The only thing I could do safely, I finally decided, was to go back to bed and hope for the best. Even then the crashing in the woods across the street continued to come to my ears.

There is no doubt that artists may see beauty in a storm such as I have tried to describe. It is hard not to see it, but it is also hard not to recognize the damage that is being done, both to the works of man and of Nature. Man can repair a broken telephone line in a few hours at the cost of a few dollars, but he cannot grow a new white birch, or patch up a mutilated elm, or restore a basswood or tulip tree. Such catastrophes, of course, hit harder at those who depend for their livelihood on the products of trees. An ice storm cannot be a thing of beauty to such persons. Neither can we restore to birds and mammals the den trees and nesting sites that may have been ruined by this ice storm.

But an ice storm has effects on areas other than those that are up off the ground. Sometimes such a storm may coat a deep bed of snow with a crust too hard and thick for ordinary forms of wildlife to penetrate. Grouse and other forms of wildlife that may have found shelter in a bed of snow may be hopelessly trapped and destroyed. Not infrequently long-tailed pheasants that have been resting on the ground find their tails frozen down or loaded down with balls of ice. Obviously these serve as handicaps that they must overcome if they are to survive.

A crust of ice over snow may be highly selective in its influence on wildlife. The weight of the animals that must run over it makes a lot of difference. If a heavy deer is pursued by a light-weight dog, the deer will break through the crust in making its escape, while the dog can run freely on it. This gives the dog an advantage it really may not need. Similarly, other heavier animals like rabbits are at a disadvantage in escaping a lighter-weight weasel, and so the story goes. Just take a good walk some day when there is a good crust and see what you can learn, from tracks, how this selective system works. The ice may be bad enough when it seals over the food supply of some hard-pressed wildlife, or when it seals in a creature that has sought shelter under snow, but when it seems to bend the balance still farther and aids those forms of life that are normally the aggressors, and handicaps those that are hard-pressed, then we wonder whether ice is really nice or not. Of course, we know that it assumes no authority over the fate of organisms deliberately, aiding one group while harming another, but sometimes it almost seems as though things were that way.

One of the more conspicuous forms in which we find ice in winter outdoors is in the shape of icicles. These may hang from twigs, from wires, from roofs, from the sides of gorges, or from almost any sort of elevation. They are slender or coarse, long or short, smooth or rough, clear or opaque, crowded or solitary, and each variation has a significance that may be interpreted if we are willing to spend the time and effort. Why more persons are not injured by icicles when they break loose from their supports is hard to understand since they hang like myriad spears, precariously supported and capable of wiping out a human life in an instant.

Icicles, of course, are commonly formed by water running down from a warm area into a cold area at sufficient speed to permit it to accumulate in a frozen form in the region of lower temperatures. Examine a few to see if you can find any that are hollow. Determine whether, in your judgment, they grow only through water freezing to the outer surface. See if you can discover why some are clear while others are foggy, and under what conditions each kind is formed. Read the school page for further suggestions on studies of this sort.

Earlier in this article we quoted the dictionary as saying that ice was brittle. Does this mean it cannot be bent? If you think so, break off an icicle and fasten it from one end in a support that will hold it in a horizontal position. Leave the icicle in this position for a day or so and (Continued on page 146)

Soil Pros and Cons

By ANDREW S. WING

Executive Secretary, National Garden Institute

Illustrations from U. S. Department of Agriculture

THERE are not many people who really understand soils; fewer still who have all the knowledge available about the land we live on. Doubtless we shall never know *all* of the answers. There are, however, some things we *do* know about the handling of soils, although even some of those are subject to dispute. This is an honest attempt to explore some of the practical aspects of the problem from a layman's viewpoint.

To plow or not to plow is a moot question. Shall we mulch instead of cultivate? Should we use compost or manures instead of chemical fertilizer? Is the use of insecticides and other chemicals ruining the land? In short, should we go along with the chemical experts, or the advocates of organic gardening and farming? Or is it better to follow a middle course between the two extremes? There is much to be said on both sides, and it is being said by intelligent and articulate people.

Let us consider plowing, and its smaller counterpart, the spading of a small plot. As a farm boy in Ohio, and as a graduate in agriculture at Ohio State, I never heard of anything else. After all, how could you plant unless you turned the soil over? Our soils were mostly a pretty stiff clay, so we not only plowed as deep as we could, but we also did a thorough job of cultivating. A fine soil bed, plus a dust mulch through the summer months, was the mark of a good farmer, and, on the whole, it paid off. Of course, in those days soils were newer; good farm hands got fifteen cents an hour for a ten-hour day. We thought there was only one way to do things.

Then an ex-county agent in Ohio named Edward H. Faulkner wrote an interesting and widely read book called *Plowman's Folly*. He said that plowing was not only foolish but downright criminal; that it was ruining the land. Faddists espoused his view in a big way, and also a number of other intelligent people. There was a good deal that sounded like sense in what Faulkner said, and he published a second book in which he corrected or modified some of the things he said in the first. That book sold pretty well, too, and attracted more attention. It was good stuff. Anything that stirs up interest in gardening and the land is helpful.

But, whereas Mr. Faulkner claimed that the moldboard plow was the ruination of agriculture (he was not the first to say this either), most farmers kept on plowing anyway and growing bigger and better crops at less cost per acre, thanks to the gasoline tractor and power machinery.

Ernie Moore, wartime sparkplug of the U.S.D.A. Victory Garden campaign, appears to be an advocate of deep turnover in his own garden.

To test Mr. Faulkner's theory, I tried gardening without plowing last summer. This was partly because our faithful plowman failed to show up in time. The weather was wet and the earth not in too good shape for plowing, so I used a simple wheel-hoe plow, up and down hill. This scratched the surface, and did more good to my waistline than to the top soil. The results were not too happy, but may have been due to the weather, which continued wet and cool. I still think it would have been better if the land had been plowed, to give at least a little aeration to the soil, but I could not prove it. Had there been a cover crop of rye, ryegrass or something else to turn under, I just do not know how I would have ever managed it, the garden space being roughly sixty by sixty feet, much too large to spade up properly weekends, which is all the time I have for gardening.

The late summer and fall crops came along fine, without anything except a fairly deep stirring of the soil in the rows, plus chemical (4-8-6) fertilization and the usual wheel-hoeing and pulling to keep down the weeds. If there had been subsoiling, or a generous application of manure or humus, it might have been better. In fact, I am sure it would have been, but none of these soil ameliorants was available, even if I had had the time or means to apply them to my garden.

I therefore lay it mostly to the weather that my early garden was late and not productive. Rain and more rain, with subnormal temperatures and little sun were not good, even on the part of my garden that had a down-hill slope and a rather gravelly character. Comparisons with other gardeners confirmed this belief.

Nevertheless, I am sure that, if I had supplied more humus to the soil, it would have been better and that the late garden, which did well compared to the early crops, in spite of a drought in August, would also have been more healthy and productive.

This introduces the next question—that of the use of chemicals versus organics. I was taught to believe that the use of chemical fertilizers, including such strong ones as superphosphates and nitrate of soda, was all right, in fact it was the thing to do, although on the home farm we did prefer basic slag to superphosphate because of its lime content and alkaline reaction. But our Ohio soils were then mostly rich in lime and lacked chiefly phosphorus, and, in some places, potassium. Our crops, too, were grown in rotation—corn, barley, alfalfa, with frequent stands of alfalfa of from two to five years, depending on the winters and how the stand hung on. That meant practically a fallow period of several years when the roots of the alfalfa would go deeper and deeper and the leaves would fall off to make a light mulch or humus on the ground. And all that time the bacteria on the roots of the alfalfa would be gathering valuable nitrogen from the air in available organic form.

What has all this got to do with gardening today? Simply that I am trying to rationalize present theories in terms of the practices I knew as a young man. Our rather rundown farm grew richer every year thanks to lime (in the soil), legumes (alfalfa chiefly), manure (lambs') and good tillage. We grew as much as 100 bushels of corn to the acre, and that was before the days of hybrid corn. My brother David, who farms the home place now and more than a thousand other acres, does as well, or better, today with essentially the same rotation and practices, except that now it is necessary to use lime, and wheat has displaced barley in the rotation. Soy beans, another legume with strong roots, have also assumed an important role in the farming picture of the Midwest. To produce what farmers did during the war years without chemicals would have been an utter impossibility.

But to get back to gardening. I am sure that the organic gardening advocates are correct up to a certain point. By that I mean that most soils that have been cultivated a number of years without the annual addition of organic matter in the form of compost, manure, soiling crops (rye, winter vetch, ryegrass etc.) are deficient in humus, and therefore are not as productive as they would be otherwise. I cannot prove this, without data, but I am sure that I am right and that further scientific studies, as well as practical experience, will prove beyond a shadow of a doubt

that this is true. Well, why not, if you consider the nature of plants and their habits of growth? It is organic matter mixed with rock particles that makes soil, and while plants have the ability to assimilate crude mineral elements, most cultivated plants thrive better if there is organic matter for the roots to penetrate, and when the organic matter is exhausted, the plants have a harder time feeding and keeping healthy, even if plant food in chemical form is supplied regularly. Every soil expert that I know agrees on this point. Soil humus is a vital need of plants. Beyond that there is considerable disagreement between the advocates of organic gardening and those who believe in chemicals, or what the organic followers choose to call "artificials."

The compost crowd insists that the use of any chemicals, except such harmless substances as ground limestone and raw rock phosphate, "poisons the soil." This is also true of insecticides and weedicides, they claim. Not only are the soil organisms, such as bacteria and fungi, destroyed, but also the earthworms, they assert. If true, this is bad, and there seems to be some evidence that it is true. On the other hand, Dr. Firman E. Bear, head of the Department of Soils of the New Jersey Experiment Station, an old friend and my agricultural chemistry teacher at Ohio State University, made a count and says that it is not entirely true, for while chemicals may decrease the earthworm count somewhat, there are plenty left behind to do a job of soil aeration and rejuvenation.

Who knows what is right and what is not? My own feeling is one of doubt and confusion. We have a prosperous and successful agriculture built to a large

Ernie Moore had a good aide in Ernie, Junior, who seems to take care of the organic side of things. At the left he wheels a load of wheat straw to make a mulch against hot and dry weather, and, right, adds vegetable tops and other garden refuse to the compost pile.

extent on the use of chemicals. Is it as haywire as the organic crowd would have us believe? Frankly, I do not think so. And yet their claims are so plausible as to make one wonder. All I can say is that the best gardeners I know use a good deal of organic plant food: dried cow manure—if they cannot get the fresh—bone meal, fish meal, peat moss, composts, mulches, and what have you. All would rather have good decomposed barnyard manure, cow, horse, sheep, even chicken, if they could get it.

The organic enthusiasts insist that even straight manure is not quite good enough, that it should be composted with lime, other organic matter, and soil, to be most effective. They may be right, but handling a big enough compost heap for a large garden, or for a farm, is quite a task. The late Sir Albert Howard of England, the patron saint of the organic gardeners, wrote that his wife could turn over two tons of compost in a day or so. But how many of us have wives who are capable of doing that, even if they were willing to do so? In the countries where Sir Albert pioneered as a plant pathologist and soil expert—the West Indies, India, South Africa, and elsewhere—he always had an abundant supply of cheap labor. He admits that in England, and in other countries where labor is scarce and expensive today, the use of power hoists and other machinery is both economical and essential.

And yet the effort may be worthwhile, at least on a small place. There is considerable testimony to the effect that, where only organic fertilizer is used, crop yields and pastures are not only kept up but attacks of insects and plant diseases become less serious. I have seen this up at Sam Ogden's place in the Green Mountains of Vermont, where he has an ideal location and an abundant source of barnyard manure. But even this superlative gardener has to spray or dust now and then to ward off certain insect pests. Certainly his crops of peas, corn, carrots, and such, grown with compost, are superb.

Sir Albert Howard and Lady Eve B. Balfour in England, J. I. Rodale, editor of *Organic Gardening* of Emmaus, Pennsylvania, Louis Bromfield of Malabar Farm, Ohio, and others have written eloquently and earnestly about the importance of humus and in opposition to the use or over-use of chemicals. Professor Selman A. Waksman of Rutgers University, who was the discoverer of streptomycin, says, "Plant deficiency diseases are usually less severe in soil well supplied with organic matter, not only because of the increased vigor of the plants, but also because of antagonistic effects of the various soil microorganisms which become more active in the presence of an abundance of organic matter." Professor Waksman is a first rate scientist, whereas most of the advocates of organic gardening are amateurs, albeit able and sincere. What he says must be noticed, but he does believe in the use of chemical fertilizers.

What we need is more light, more exact information based on scientific research such as Dr. William A. Albrecht is doing at the University of Missouri. Dr. Albrecht found that farm animals have an uncanny ability to select their own foods instinctively from a mineral standpoint. When given a choice they will take the high-mineral-content hay or pasture grasses every time; that is, (Continued on page 148)

The Man of Grass

By H. W. HIGMAN

A CENTURY and a quarter ago David Douglas visited the Pacific Northwest for the purpose of collecting plants and seeds. Although he had been sent out by the Horticultural Society of London, he headed no elaborate expedition. On the contrary, he traveled lightly and simply. With a small pack, papers to contain his botanical specimens, a firearm for collecting birds and mammals, trinkets, and a few feet of tobacco for trade purposes, he trudged through the forests alone, or with Indian guides. On longer trips he used Indian canoes, hitch-hiked in the bateaux of the Hudson's Bay Company, or covered the rough trails on horses, sometimes obtained from the Indians, sometimes borrowed from the company.

His journal records many hardships. He began his trips with a meager supply of fish or meat, flour, sugar and tea. Then he lived off the country. If he found game he lived well; if he failed, he fasted, often for a day or more. One evening he was so exhausted that he fell asleep while waiting for two partridges to boil for supper. He awoke at daybreak to find his birds burned to ashes and his only kettle ruined. Continual rains spoiled his plants, soaked his blanket, and prevented his bird collecting.

To the Indians he was the *Man of Grass*, a bad spirit to be respected and feared. They put their hands to their mouths in dread when he put on his spectacles. When he made an effervescent draught they thought he drank *boiling* water. They had no experience with wing-shooting, and his uncanny ability to bring down a flying bird made him famous. Because he lighted his pipe with a lens they called him "Olla-piska, which in the Chenook tongue signifies *fire*."

To preserve his collections required constant effort. Swift rapids capsized his canoe and swept away the results of weeks of hard work. Wet weather delayed drying and caused mold. If his material finally reached shipboard in good shape, it frequently decayed during the long voyage. A calumet (golden) eagle, which he hoped to take alive to England, strangled in its tether cord after it had been transported for hundreds of miles.

David Douglas, describing the great fir named for him, noted that those trees growing in some situations are branched to the very ground, while those in dense forest are unusually straight and destitute of branches to the height of as much as one hundred and forty feet.

Douglas covered the country like an old-time prospector. It took only the sight of some pine nuts in a native's pouch to send him on a two-month journey to locate the trees they came from. He found the giant pines, but just escaped being killed by Indians. He visited California, Oregon, Washington and Idaho, stood at the source of the Columbia River in the Rockies, and made the long trip to York Factory on Hudson Bay, whence he sailed for England.

Douglas thoroughly explored the great rain forest. He admired the luxuriance of the salal and spoke of the beauty of the salmon-berry, and of the many new plants that he found. He measured and described the commonest big tree of the region. He commented that in some situations these trees "are thickly clad to the very ground with widespreading pendant branches" but those in the dense gloomy forests "are more than usually straight, the trunks being destitute of branches to the height of 100 to 140 feet."

This great tree bears his name—Douglas Fir. For three-quarters of a century it (Continued on page 144)

A Sun-Bathing Brown Thrasher

By JOHN V. DENNIS

ONE of the most interesting traits exhibited by a young brown thrasher, raised in captivity and released at the Moose Hill Bird Sanctuary in Sharon, Massachusetts, is that of sun-bathing. Wherever there is a hard surface and sunny spot, "Brownie," as he is called, suddenly falls forward, touching the ground with his head, spreading his wings and tail, ruffling his feathers and kicking his legs out behind him. Then, bobbing back into the frozen attitude shown in the photograph, he suns himself for several minutes. While in this position his bill is held open and his eyes take on a nonsensical, vacant stare.

When "Brownie" was released in June, he continued to frequent the neighborhood of the house, begging food from whoever happened by. As the weeks passed, he continued to remain tame, perching on one's head or shoulders and entering doorways. On one occasion when he entered my bird-banding shed, I released a newly banded cowbird. The cowbird caught sight of "Brownie," and, instead of flying away, hopped about for several minutes

exhibiting great curiosity over the presence of another bird. "Brownie" himself frequently wanders into banding traps. When caught, he does not try to beat his way out as most birds, but calmly waits until I release him.

Thus I have had ample opportunity to observe "Brownie" and to note his addiction to sun-bathing. His favorite spot is a side-porch where he is most often found ecstatically enjoying a sun-bath. Another spot is a tin roof. Even though these are hard surfaces, he first goes through the motions of scratching a hole as though he were in a dirt roadway. I have noted sun-bathing in many birds, but in none have I seen such persistence or definite abandonment.

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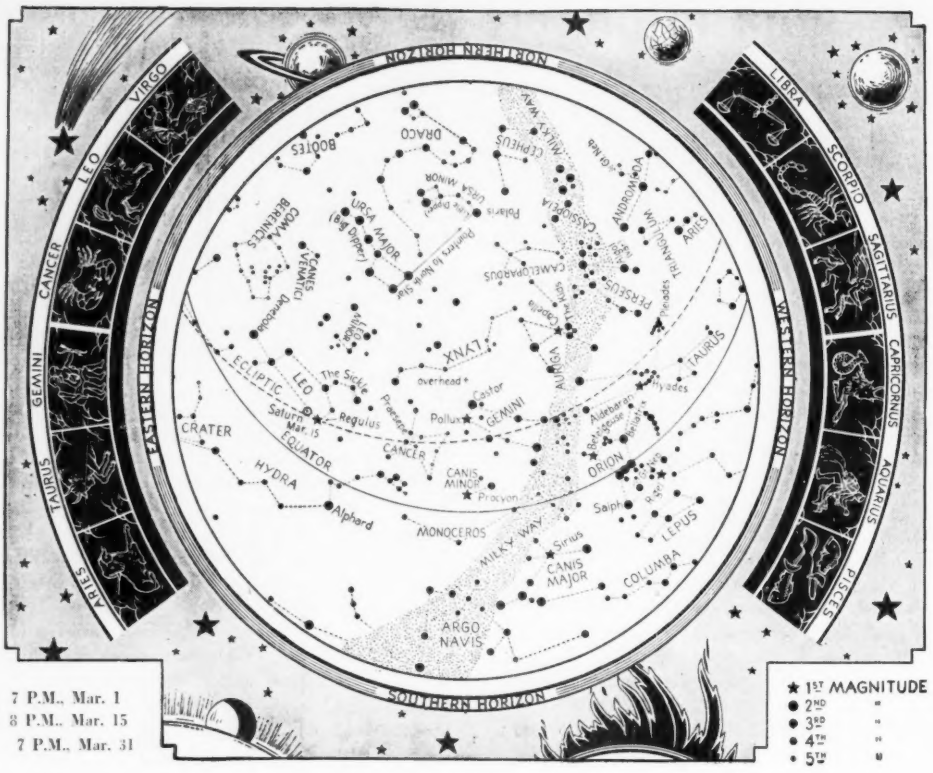
An Animal Geography Lesson

By GEORGE W. LYON

A GLANCE at any map of the United States or Canada will show that a number of mammals and birds have left their names here and there on the map. Below are hints to help you to identify the place names. Wtihout using a map, see how many you can name correctly. Ten or twelve correct is a good average. Answers on page 144.

1. Of course this big city could have been named Bison.
2. Equine heads is what village of New York State?
3. Part of the anatomy of a large ruminant names a Canadian city.
4. A mountain and a bridge in the Hudson River area.
5 The scene of an early battle of the Civil War.
6. A fractious domestic animal names a canyon in the Canadian Rockies.
7. A bird and a mountain lake name a resort in Pennsylvania.
8. An industrious animal plus a cataract equals a Pennsylvania city.
9. A feline plus the Dutch word for creek or brook equals Rip's sleeping resort.
10. A plain plus a dog (French) names a Wisconsin town.
11. A town in Maine that could have been called Reindeer.
12. A Minnesota city named for a bird, an Indian maiden or both.
13. An Oklahoma town named for a bird angler.
14. In Wisconsin a knowing animal plus land projecting into water.
15. In Georgia a bird of spring plus a meadow.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

How to Know the Planets

By ISABEL M. LEWIS

THERE are various ways of distinguishing the planets from the stars that lie far beyond them. Planets shine with a much steadier light than the stars, a light that is reflected light of the sun. Planets do not twinkle or scintillate appreciably. This is particularly true of the giant planet of the solar system, Jupiter, which shines with a remarkably calm and steadfast light. Venus, and, more especially, Mercury, do at times shine with considerable unsteadiness of light when the dense layers of atmosphere near the horizon may abnormally deflect their rays at low altitudes. Mercury was even at times called "The Twinkler" by the ancients.

With access to a telescope one has no trouble in identifying a planet by its characteristic disk. Mercury and Venus, moreover, show, in the telescope, phases similar to those of the moon because their orbits lie between the orbit of the earth and the sun. The albedo, or reflecting power, of Venus is greater than that of any other planet, and it is of dazzling brilliancy, very different in appearance from Mercury, which has faint markings on its disk. So dense is the atmosphere of Venus that light never penetrates to its surface, and there is no break in its veil of clouds. Mars, Jupiter, Saturn, Uranus, and Neptune all have their distinctive disks and peculiar surface features that readily distinguish them from other planets. Pluto is the only major planet that, because of its great distance from the earth and small size, shows no disk but appears like a small, faint star in the telescope. We are interested here only in the five brightest planets, however, all easily visible without telescopic aid.

Planets are easily recognized as such—if one observes them on a number of successive nights—by their motion relative to fixed stars among which they

appear to move. It will soon be noticed, moreover, that the planets never appear outside of the Zodiac, that belt or zone in the heavens that extends eight degrees to either side of the ecliptic.

If one could look down upon the orbits of the planets from the direction of the north pole of the heavens, it would be noted that they are all inclined at very small angles to the plane of the earth's orbit. All of them, with the exception of Saturn, Venus, Mercury, and Pluto, are inclined less than two degrees to the orbit of the earth. The inclination of Saturn's orbit is only slightly less—two and one-half degrees—than that of Venus, which is about three and a half degrees, while the orbits of Mercury and Pluto are tipped to that of the earth at the comparatively large angles of seven and seventeen degrees respectively. It would also be noted that all the planets were moving in their orbits around the sun in the counter-clockwise, or west-to-east direction. This is true of most of the satellites of the planets as well. This usual direction of motion of the planets is spoken of as direct motion. If the motion is clockwise, or in the east-to-west direction, it is called retrograde motion, as distinguished from direct motion, and the body is said to be retrograding.

The motion of the other planets as viewed from the earth is sometimes direct, sometimes retrograde. A planet will appear also to be stationary, as seen from the earth, when its apparent motion changes from direct to retrograde, or vice versa. All of the planets whose orbits lie outside of the earth's orbit are moving in retrograde, or in the east-to-west direction, at and near the time of opposition. It is easily seen why this is so. The nearer the planet is to the sun the more rapid its orbital motion. The mean motion of the earth in its orbit is 18½ miles per second; that of Mars about 15 miles; Jupiter about 8 miles; Saturn 6 miles, while the mean orbit velocities of Uranus and Neptune are, respectively, about 4¼ and 3 miles per second. Near time of opposition the planet and the earth are on the same side of the sun and both are moving around the sun in the same west-to-east direction, but the earth, being nearer to the sun, moves more rapidly than the outer planet and, as a result, there comes a time when the planet falls behind the earth and apparently moves in the opposite direction, or retrogrades, after first reaching a stationary point. As both planets move onward in their orbits there comes a time when the outer planet ceases to fall behind, reaches a stationary point again and then resumes direct motion. If the path of a planet, as seen from the earth, were traced on a sky map it would have strange loops and curves, although for most of the time its motion would be west to east, or direct. It would also be confined to the Zodiac. One need never look for planets among the circumpolar constellations, either northern or southern, or, in fact, more than thirty degrees north or south of the celestial equator. This fortunately limits the possibilities of mistaking some bright star in these regions for a bright planet.

Planets whose orbits lie beyond that of the earth *always* retrograde for some time around the date of opposition. They are always shifting westward in position relative to the sun, however. Shortly before conjunction, an outer planet—Mars, Jupiter, or Saturn—is seen, we will say, close to the western horizon in the evening twilight. It is nearing conjunction with the sun. Soon it will disappear in the rays of the setting sun. Shortly after it will be in line with earth and sun, with the sun between earth and planet. It will next be seen west of the sun close to the eastern horizon before sunrise. Its distance west of the sun will steadily increase until a point is reached, some days before opposition, at which the planet becomes stationary. From then on through opposition, and for some days after, it retrogrades, finally reaches a stationary point once more, and after that resumes direct motion. It soon passes into the western evening sky, draws in toward the sun once more, and another conjunction takes place. The planet's circuit of the heavens relative to the sun has been completed.

Parallels

By OSCAR OSTLUND

The *dictator,*
adept at swordplay;
master of the showy thrust.

The *meteor,*
which flares up brightest,
just before it hits the dust.

The inner planets, Mercury and Venus, of course, move more rapidly in their orbits than the earth. The mean orbital velocity of Venus is about 21½ miles per second, and that of Mercury is about 30 miles per second. Both of these planets appear to oscillate back and forth in their orbits relative to the sun. Unlike the outer planets they are never at opposition; they are at inferior conjunction when between the earth and sun, and at superior conjunction when the sun is between them and the earth. They also have points of greatest eastern and western elongation when at their greatest angular distance east or west of the sun. When at inferior conjunction, and for a short period before and after it, both Mercury and Venus are retrograding, but, for the remainder of the time, from before western elongation through superior conjunction until after eastern elongation, both planets are moving in the west-to-east direction. As with the outer planets, stationary points occur at the time the direction of motion relative to the earth changes from direct to retrograde, or vice versa.

It will be found instructive, as well as interesting, to follow the changing positions of the planets relative to bright or easily recognized stars in the background. When one speaks of the planets moving "among the stars" one means, of course, the motion of the planets as seen projected against the stellar background. So enormous are the distances that separate our solar system from (Continued on page 148)

Camera Trails

By EDNA HOFFMAN EVANS

MARCH is a rather unphotogenic month; at least it seems that way to me. It is neither fish nor fowl—neither winter nor spring—just an in-between time of bare trees, brown lawns, snow, slush, or just plain mud, depending on the latitude where one happens to be.

For that reason, an appropriate "Camera Trails" for March is something of a problem. And it is a problem I have solved, heretofore, by launching forth into some photographic subject that may or may not be very closely allied to Nature and pictures thereof.

Last March I delved fairly deep into the history and development of photography. This March I am going to take up another phase—photography in connection with the law.

Being something of a whodonit mystery fan, I have always wondered why nobody has written a thriller wherein the hero cracks the case by means of his trusty camera. At least I cannot recall a whodonit in which photography plays anything but a minor role—apparently Perry Mason, Nero Wolfe or Mr. and Mrs. North just are not camera fans. Maybe, some day, if the spirit moves me, I will try writing *The Case of the Candid Camera* myself.

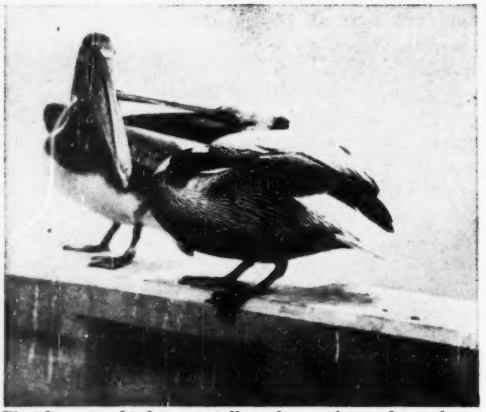
Some months ago I ran across a most interesting book on the legal aspects of photography; that is, how lawyers can make use of photography in the presentation of their cases. It is definitely a law book, but it contains informative material worth the perusal of any photo fan.

The book I mean is *Photographic Evidence*, written by Charles C. Scott, who is a member of the Kansas City, Mo., bar, and published by the Vernon Law Book Company in the same city. Published originally in 1942, the brown-leather-bound, formidable-looking tome has a 1947 supplement that adds recent camera material and brings the cases closer up to date.

Before reading the book, I had not realized that photography could play such an important part in legal matters. Nor did I know that it had been doing so to an increasingly greater extent since 1859, when an American appellate court first ruled photographs admissible as evidence when relevant and properly verified. That was back in the days when photography was still in its infancy, a good three decades before lenses were dependable and nearly half a century before the development of usable, commercially prepared photographic plates.

Nowadays, courts not only permit the presentation of black-and-white prints as evidence, but also color pictures, silent and sound movies, infrared shots, macro- and micro-photographs, and X-rays. Says Attorney Scott, in the preface to his book: "Whether he realizes it or not, the modern lawyer would be as handicapped should he be deprived of the use of photographs as evidence as would the physician were he forced to practice without his clinical camera and X-ray apparatus. Photography, therefore, is not merely one of those subjects every lawyer should understand but probably doesn't; it is an essential medium for the presentation of evidence that all lawyers should master."

The book is divided into two sections, the first being devoted to the preparation and the second to the presentation of photographic evidence. That first part contains some of the best how-to-do-it material that I have ever met, including all the photographic books I have read. There is a discussion of cameras and auxiliary equipment, such as supplementary lenses, filters, flash attachments and the like. The author preserves a judicial impartiality, pointing out that box cameras have produced pictures that have been admirable from the standpoint of evidence. But he also has this to say on the subject: "While a box camera may be used in legal work as a matter



Florida water birds, especially pelicans, have always been camera subjects close to the author's heart.

of necessity, it is obvious that when obtaining photographs to support a case the lawyer should not make the mistake of entrusting their preparation to the inexperienced snapshooter with a roll of film and a dollar camera. The preparation of photographic evidence is one of the most technical branches of photography. The courts have always recognized this fact and in many decisions reference is made to the fact that the accuracy of the photograph is in part dependent upon the type of camera used."

So much for the court's-eye view of photography. Since there is a dash of Junior G-man in all of us, just how could our respective cameras be used to trace down criminals, and make certain that justice always triumphs?

Most spectacular occasions, of course, are those in which the camera actually catches the criminal in the act. This does not often happen, but occasionally it does. For example, a newspaper photographer once helped convict a defendant in a Pennsylvania riot and assault case. Said defendant claimed to be an "innocent bystander" in the affair, but was unable to satisfactorily explain the weapon that the picture showed her to be carrying. Another time, a casual snapshot made from a passing steamer showed the body of a man falling from the masthead of a small sailboat, thereby exonerating another man from the charge of conking the victim on the head with an oar.

Most famous of all camera detective stories dates back to the assassination of President McKinley, when the crude motion picture cameras of the day ground out foot after foot of film showing the wild-eyed actions of the assassin. More recently, a newsreel photographer, working with a telephoto lens a block away, was able to supply evidence against the trio who assaulted Leon Blum, the French statesman, in a pre-election riot.

Occasionally, criminals can be detected by means of planned pictures—camera traps set at likely spots and operated in connection with burglar alarms. Evidence also can be obtained by means of tiny concealed cameras—the Eastman Company developed a special "match box camera" for use by OSS and underground forces during the war. The camera, just matchbox size, took half-inch square pictures, thirty to a roll; it could be shot from the hip without focusing, simply by aiming at the subject and pushing a small plunger. A "vestpocket darkroom kit" was supplied with the match box camera, and thus photography found its place in the cloak and dagger aspect of warfare.

At times the camera can detect clues that are invisible to the human eye. In a French case, after a thorough search failed to reveal any bloodstains in a room suspected of having been the scene of a homicide, a photograph revealed a large washed stain on the carpet. In other cases, fingerprints too faint to be

March sky in Texas. Only a few leaves have hung on during the cold months to flaunt their silhouettes against the steel-gray sky.

studied with the naked eye have been photographed and used for identification purposes.

But instances like those mentioned above are rather rare in comparison to the vast quantities of photographs used in legal proceedings. Every mystery story reader knows how the police photographer takes his shots before anything is touched at the scene of the crime. But not all those pictures can be presented to the jury. Some judges have ruled against the presentation of pictures that are too gruesome or horrible, on the grounds that they might prejudice the jury unnecessarily.

Less spectacularly, photographs are used in cases where claims are made for damages in connection with automobile, industrial and miscellaneous accidents, condemnation suits, fire, flood and windstorm losses, mortgage or sale controversies, cases involving trespassing, and many others. They can also be used to dispute such claims.

Photography plays a major role, too, in cases of forgery, where enlargements of writing in question show the unmistakable quavers and hesitations that occur when one traces or writes unnaturally. Idiosyncrasies in typing show up under photographic enlargement. So do the different shades of ink that result when an original writing is changed, or added to at some later date. Erasures, whether by abrasives or by chemicals, show up under photography. Also, burned and charred documents can be restored to legibility by infrared photography.

X-ray photographs are used rather often as legal evidence. They may be presented to show the nature and extent of internal injuries or the presence of foreign substances in the body. They also may be used for purposes of identification—sometimes the bone and tooth structures are just as revealing as fingerprints would be.

Just as is possible in many other activities, photographic evidence can be faked or distorted, either intentionally or through carelessness or lack of skill on the part of the photographer. Position of the camera, type of lens, amount of exposure and sensitivity of film all can play a part in presenting evidence—truthfully or untruthfully.

It is really remarkable how the camera can serve as a faithful aid to the law and justice, and how, on the other hand, it can evade, falsify and lie, just as skilfully as any underworld mastermind.

For Camera Trailsmen with a leaning toward law, and especially for those who are members of the bar, this book on *Photographic Evidence* will prove interesting reading and a valuable addition to a legal or photographic library.

ODDS AND ENDS

While we are on the subject of books, I am glad to see new photograph-illustrated ones about birds marching forth from the publishers. Since Florida water birds are especially close to my heart, I welcome Helen G. and Allan Cruickshank's *Flight Into Sunshine*. He took the pictures and she did the writing.

Also newly added to my library shelves is Roger Tory Peterson's *Birds Over America*, with its eighty pages of photographs. Bird books were few and far between during the war years, and I am glad to see them coming out again.

There is an interesting article by H. H. Sheldon on "Getting Closer to Animals" in the winter issue of *Defender News*, published by Du Pont. You may be able to get a copy from your camera store, or by writing the Du Pont Photo Products Dept., Wilmington 98, Del.

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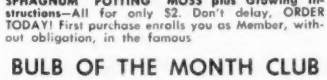

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LIFE IN THE RAW

(Continued from page 124)

enigma, this amazing bit of life that oozes stealthily away to hide beneath a piece of bark or a leaf, is a good example of the astonishing and beautiful things so many of us miss because we fail to look and learn. If we would take time out of our familiar, sometimes monotonous, man-made world to observe closely the little things in Nature, how often we would be rewarded by the exciting adventure of exploring an amazing miniature world as fantastic and exotic as that of some far-distant planet.

Lyle Watts Reports

After a half-century of progress, our National Forests are now supplying nearly four billion board feet of timber annually, says Lyle Watts, Chief of the U. S. Forest Service, in his annual report, which in part reviews the past five decades. Full development of this resource can bring about an annual return of six billion board feet on a sustained yield basis, he adds. The system now created, Mr. Watts states, "has been and will continue to be the very foundation on which scientific forestry—forest conservation—in America is based. The National Forests, however, cannot meet the national demand alone. Although they now have thirty percent of the sawtimber volume they include only sixteen percent of the country's 461,000,000 acres of commercial forest land. We must still rely upon private lands for the bulk of our timber supply. Better private forest management is, therefore, vital, and a Federal-State plan for control of timber cutting and related practices on private land sufficient to prevent destructive practices and to assure that the land is kept reasonably productive" is urged. Increased public aid in fire protection and insect and disease control, increased technical advice and assistance for forest-land owners and processors, public aid in the development of cooperative management and marketing, and provision for long-term, low-interest financing are recommended.

Rockland County Flowers

A live-wire outdoor organization is the Rockland Audubon Society, West Nyack, New York, and its members do not confine their interest to birds alone. Proof of this is found in a mimeographed bulletin entitled "The Flowers that Bloom in the Spring." It is a calendar of the blooming of 144 spring flowers in the woods and fields, swamps and roadsides of Rockland County, New York. It was compiled by John M. Price, and is based upon a dozen years of watching these flowers for their earliest appearances. Copies are available for fifteen cents from the Rockland Audubon Society.

PROFILE OF A HAWK

(Continued from page 130)

inherited wild instincts seemed to possess her for the first time in her life.

In the meantime I had hunted up a snake, which I tossed to her. Her talons met the reptile in mid-air. Returning to her perch, she immediately snapped off its head. Then, with a loud "gazook, gazook," and still clutching the snake, she sailed off across the wooded valley. I never saw Wagtail again. Still, the hope lingers that some day, as I stand beneath a mature woodland beech or maple, gazing up into those mysterious leafy branches, a large red-shouldered hawk, sitting on her nest high above, will lean over the edge and call down to me "gazook, gazook."

"Pelletized" Seeds

Here is something new in gardening—the "pelletized" seed. Tiny, hard-to-handle seeds, like carrots or petunias, can now be had encased in a coating of soluble materials containing fungicides, insecticides, fertilizer, hormones and inert matter. The pellets are about the shape of a pea, although smaller. Thus space planting is possible with these tiny seeds. Also the seeds, thus protectively covered, can be planted earlier in the garden instead of in flats, and they are given a better start in life by virtue of the coating about them. This new departure is announced by Henry A. Dreer of Philadelphia, and makes use of techniques developed by the Dow Chemical Company in connection with sugar beet seed.

Conservation Caravan

Under the joint sponsorship of the Buffalo Museum of Science and the Conservation Forum of New York State, a new experiment in conservation education, will be tried out next June. This will be known as the Conservation Caravan, a ten-day conservation school on wheels. Students will travel in private cars, four to the car, and instructors will move with the convoy. A carefully selected route has been chosen to afford a wide variety of conservation experiences. Fee for instruction and all living expenses will be fifty dollars. Full details may be obtained from Conservation Caravan, Buffalo Museum of Science, Buffalo 11, N. Y.

THE MAN OF GRASS

(Continued from page 138)

has been the principal contributor to the prosperity of the region where it occurs. Huge saws have fashioned its trunks into lumber. Veneer plants have peeled thin strips from the logs and have glued millions of feet of it into plywood. Fleets of ships and trainloads of cars transport the product over the globe.

Douglas died, at the age of 36, in as spectacular a manner as he had lived. There was a cattle trap outside a native village in Hawaii, where he was botanizing, a wild bullock in the trap, a too close approach by the always curious collector, a slip, and the still young scientist went to as fantastic and gruesome an end as could be devised by any movie writer.

Sydney Stephens

On the "Contents Noted" page in this issue of *Nature Magazine* we quote from an article by Dr. Ira N. Gabrielson with regard to the weaknesses of state wildlife administration. In his article he said that the situation would be more reassuring if the level achieved in a half-dozen states could be reached everywhere. Dr. Gabrielson did not cite the half-dozen states, but we are certain that one he had in mind is Missouri. There the administration of wildlife has been taken out of politics and placed on a sound and scientific basis. Chiefly responsible for ousting the politician was Sydney Stephens, chairman of the Missouri Conservation Commission for the first ten years of its existence. Syd Stephens passed away in October, 1948, but he left behind a sound organization under the direction of I. T. Bode. This achievement is Syd Stephens' monument, and the December issue *of Missouri Conservationist* pays fitting tribute to the man who showed the way.

Correspond?

T. M. Robinson, Hockerhill Farm, Brewood, Stafford, England, is interested in corresponding with anyone interested in Nature, bees or agriculture—all of which, together, seem to take in considerable territory.

GEOGRAPHY LESSON ANSWERS

1. Buffalo, bison the American buffalo; 2. Horseheads near Elmira, N. Y.; 3. Moosejaw, Saskatchewan, Canada; 4. Bear Mountain; 5. Bull Run, Virginia. (Run is a stream, or creek.); 6. Kicking Horse Canyon, Canadian Rockies; 7. Eagles Mere, a beauty spot in Sullivan Co., Pa.; 8. Beaver Falls, Pa.; 9. Catskill Mountains; 10. Prairie du Chien (Prairie of the Dog.); 11. Caribou, the correct name for the untamed reindeer; 12. Red Wing, Minn.; 13. Kingfisher, Oklahoma; 14. Fox Point, Wisconsin; 15. Robins Field, Georgia.

Forest Restoration

To determine whether recreational use of National Forests should pay some part of its own way, the U. S. Forest Service has requested its regional foresters to put a representative group of camp, picnic and winter sports areas on a charge basis at the beginning of the 1949 vacation season. This new policy is experimental, and charges are for the use of facilities, not for entrance into National Forests. This plan has been undertaken in response to repeated urgings from Congress that recreational use of these areas should bring in some revenues to offset, at least in part, the cost of constructing, maintaining and administering such facilities. Recreational use of the forests has increased steadily, imposing a growing administrative and maintenance burden, and requiring funds intended for purely forest purposes.

NORTHWARD HO!

By W. L. McATEE

For at least a few decades, naturalists of the United States have observed an apparent northward movement of various birds and mammals that they had come to regard as of southern types. These have included the cardinal, Carolina wren, mockingbird, tufted titmouse, gray fox, and opossum. Some of them have almost crossed a life zone, the Transition, north of that, the Carolinian, of which they were thought to be characteristic.

This advance may have begun much earlier than is now recognized, being masked by another—the response of wildlife to clearing away of the forests and the establishment of agriculture. Letting light down to the ground stimulated the growth of herbs and shrubs and greatly increased food and cover for wildlife. James Hall in "Statistics of the West" noted, in 1836, that "Birds of song but seldom enliven the gloomy monotony of the forest . . . it is not until the labor of the farmer has covered the soil with fields of grain, that the cheerful notes of the songster are heard. We have now a great variety of singing birds, which have rapidly followed the population from the other side of the mountains."

In a novel, *The Fields*, written of the pioneer period in Ohio, Conrad Richter put the same impression in dialect form: "they're a comin' in. I seed a bee bird [that is a humming bird] last summer. It's no bigger'n a snake doctor. Feeds and hums like a honey bee. Quail pa'tridges comin' in too. Redbreast robins and blue birds! . . . It's the fields that fetch them. Possum's here now and slick-tailed mice. Crows and blackbirds."

The observation of my own in this province that seemed most striking was that of the occupation by sassafras, a southern weed-tree, of the lower Michigan country denuded by the lumbering-off of the white pine. Here was a clear shift of life zone within the memory of a single generation. The cut-over tracts and the fields did "fetch them," but there was something else—a progressive amelioration of climate in the northern states, long denied, but now admitted, by the Weather Bureau. And way down deep there may be another factor—a hereditary urge to regain range lost during the age of glaciers. Then faunas and floras moved south as encroachment of the ice forced, or north as its recession permitted, and we may be recognizing only now evidence of the latest northward retreat.

THE PALE GOLDFINCH

By JESS H. LOMBARD

During the Spring of 1945 the lance-leaf cottonwoods at Dinosaur National Monument headquarters were filled with a drone as of a swarm of soprano bees. This sound was caused by insects that were preying upon aphids that infested the young leaves of the cottonwoods, as we later discovered through the antics of a group of goldfinches. Four pairs of these ambitious little birds were certainly busy working over the trees.

First observed in late June, a black and gold dandy was hanging precariously on a thin terminal twig and picking at a leaf. Binoculars showed him to be probing into a gall on the base of the leaf. He flew to another nearby leaf and we worked up closer. This time, hanging nearly upside down, he neatly sheared off the rounded top of the gall, probed a few times into the gall, then flew to another leaf. We soon located a female engaged in the same work. Then the search was on until four couples had been found all working on the same contract.

For seed-eaters, these finches showed a decided liking for the meat they were extracting from the leaf galls. Whether they were eating the aphids or the larvae of the predatory insects was not sure.

Doctor Noel D. Wygant of the Bureau of Entomology and Plant Quarantine, in identifying the insects causing the galls, said:

"There are two species involved. The gall that is globular in shape, the more common one, and occurs at the base of the leaf on the petiole, is caused by *Pemphigus populi-globuli* Fitch. The gall that occurs on the underside of the leaf on the main rib is caused by *Pemphigus balsamiferae* Williams."

In the springs of 1946 and 1947 our goldfinch friends were seen only occasionally—and there were few galls on the cottonwood leaves. Their control measures must have been as effective as they were final for the individuals controlled. We hope that the bird-land jungle telegraph notifies them of future need of control.

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IS ICE NICE?

(Continued from page 134)

notice whether it remains in its original shape or whether it becomes bent of its own weight. Does what you see confirm the idea that ice is always brittle?

While you are studying icicles you will undoubtedly notice that ice may form from snow on a roof above a border of icicles. This may be due to melting of the snow and the freezing of the water, or it may be influenced to some extent by the mere pressure of snow. Ice then may be formed by pressing snow. No doubt you have seen cases where you have stepped on snow under some conditions and found that the snow turned into ice. This changing of snow to ice on a roof, and the formation of icicles beneath, are, in some respects, the counterpart of what takes place in the formation of glaciers.

The illustration of a glacier given here shows how one may be formed by a river of ice making its way slowly down grade, gaining growth from an accumulation of snow in the highlands and meeting fate at the warmer lower levels. As the picture shows, some of these ice rivers twist and turn as they move downward, and, under these circumstances, it is difficult to continue to feel that ice is brittle under all conditions.

Glaciers of the present and of the past, like the streams of this winter and spring, carve and change the land over which they pass. Many of the richer farmlands of our country rest on lands over which glaciers have passed, or are most useful because of the great variety of minerals mixed and ground and spread by this sheet of ice that moved with a steadiness and persistence mindful of Fate itself. Many of us owe our prosperity to the land enriched by this action, even though we may not appreciate the debt we owe.

We could go on and point out the role ice plays when it forms slowly, or when it forms rapidly. In the previous unit of this series, we made some suggestions along this line. Ice crystals that form slowly, like the crystals of other substances, are more likely to be large than are those that form rapidly. Large crystals formed in the tissues of plant or animal may, of course, rupture the cells of that tissue and cause changes that may be undesirable. Our modern "quick freeze" practices as applied to foods take these differences into consideration. Because of the fact that we put this knowledge into practice I can eat, for dinner tonight, strawberries that I picked more than a year ago, and, so far as I can see, they are as fresh and delicious as they were when I first picked them.

The little definition of ice found in the dictionary may well make a good point of departure for the study of ice. As it stands, it is too academic to be satisfying to some. To others it fails to take into consideration factors that may demand that certain reservations be made. The more we try to apply it to the things we see about us at this time of the year, or to the situations about which we read in the papers, the more we may be convinced that ice may be a blessing or a curse, useful or harmful, but always interesting.

Gadget

While primarily designed as a safety device when changing a tire on the road, or as an auxiliary bright light within the car, a light gadget known as Save-Ur-Life Tire-Changing Light is of interest to those camping near the car. This clever and well-made light is equipped to be plugged into the cigaret-lighter socket of the automobile, and has enough cord so that the light, red on one side, white on the other, can be placed on the road during the tire-changing stint, or otherwise used for a variety of purposes. It is made by Alden Products Co., Brockton, Mass. A tab to be affixed to the car records the owner as safety-minded.

I Am a Hunter

By JAMES R. HAYES

THE hunting tradition, if such a thing exists, has been handed down in my family for many generations. My father was a hunter, as was his father. My earliest recollection of boyhood is of accompanying my grandfather on a squirrel hunt. I acquired a gun in my twelfth year, and shot my first grouse that autumn.

These things I mention, not in excuse but because they happened that way. Now, as a hunter, I have studied most of the angles involved in killing for sport. The more I analyze these viewpoints, the more I hope my boy will not be a hunter.

I recall in my seventh year accompanying my grandfather on a hunt in the Alleghenies of Pennsylvania. A group of hunters, working the hillside above, flushed a covey of quail, and the birds flew down over us.

Grandfather fired, and a bird went down. Crippled, it flopped off in the dry leaves, grandfather and I in pursuit. I took a dive and landed on the quail. It seemed lightly hit.

"Let me keep it," I pleaded. "Let me keep it for a pet." I held the warm ball of feathers, felt its trembling.

"It will only die," said grandfather, holding out his hand to take the bird. "Quail weren't made to be pets."

I handed over the bird. Grandfather killed it, put it in his game-pocket, and we went on up the trail. I did not understand then. For all my hunting, I guess I have never really understood.

Prior to those first hunts, I had been close to the woodsfolk. I knew secret glens where grouse could be heard drumming in the evening stillness. On lazy summer afternoons it was fine sport to whistle across the clover meadows—"Bob White!"—and hear in the distance a cheery reply—"Bob White! Bob-Bob White!"

Once, returning from fishing, I saw a great buck deer drinking at the brook. I crouched, hardly breathing, and watched from the bend of the trail. Then he scented me. Up jerked the antlered head. He stood poised for a moment, watching me, before bounding off into the laurel.

Things were somehow different after that first season with the gun. Of course, it was a great thrill to wingshoot my first grouse. Rabbit hunts over snowy fields always left me inwardly excited and breathless. Yet, little by little, I sensed my kindredship with my forest friends slipping away. It was as if a barrier had fallen between us. Where once they paused to watch me from the edge of the woods, now they scurried away at my approach.

Now, having hunted for many years, I still count myself a friend to wildlife. With fellow hunters, I have spent many a winter's day feeding game in the woods. Unarmed, I seem to sense the old barriers lifting; the want to hunt is replaced by a finer appreciation of life. The bond between us is what Charles Lamb once termed an "imperfect sympathy."

The chipmunk in my backyard has learned to take peanuts from my hand, although I cannot help feeling that his eyes distrust me. On snowy mornings my yard is crowded with feeding wildlife;

> But yet I know, where'er I go,
> That there hath passed a glory from the earth.

Rightly or wrongly, I have hunted and enjoyed my sport. If I have gained something, I suspect I have lost more. My crossroads are long behind me. The way I chose has given me countless thrills. My son, I hope, will take the other path. I often wonder what he will find there.

Bird Immigrants Viséd

Ornithologists do not see all of the birds that visit the United States, and even some of those they do detect, through mischance, never gain admittance to the official list. Hence, that list never has been, and never will be, complete. Illustrative of these conclusions is the history of a second kind of hummingbird for the eastern States, where the occurrence of only a single species—the rubythroat—has been formally recognized.

The story of this bird is entertainingly told in letters from John Bachman to John James Audubon, and may be found in a book by Bachman's daughter published at Charleston, South Carolina, in 1888. The first, in an intimate type of writing, dated October 26, 1832, contains the following passage: "And now, let your good lady mix you a half tumbler of claret, with a little sugar, and listen to what I have to tell you. I have another bird for you; aye, my friend, and one that will interest all lovers of Ornithology. Dr. Strobel brought me from Key West a box of birds—I tumbled and tumbled over the ragged specimens—nothing new, till I came to the little fellow, and what should he be, but a *Trochilus* (Humming-Bird) not yet figured. It is double the size of our *Calubris*, with a long bill, &c., but it is in sad order, and I am afraid it cannot be drawn. However, he was knocked from a bush by Dr. Strobel himself, at Key West—so we have now, *two* Humming Birds."

In a letter of November 11, the same year, he continued: "The new Humming Bird, I believe, to be the '*Trochilus Mango*,' or Mangrove humming bird, described, but not figured, in Shaws Zoology. I hope that we may manage to have this bird figured—when I say '*we*'—I mean 'you' and my 'amanuensis,' [i.e. daughter] Maria."

As Dr. William Daniel Strobel (1808-1884) and Dr. John Bachman (1790-1874) were both Lutheran clergymen interested in science, there is no doubt that a kind of hummingbird, other than the rubythroat, was taken at Key West. Whether any others have come, we do not know and, if they do visit our shores in the future, the voucher for their admittance as a fully recognized element of the American avifauna will be a specimen reputably reported and carefully preserved in an accessible museum collection.

W. L. M.

Grand Canyon Plants

Some typographical and taxonomic errors, and some need of additions, have developed in connection with the Bulletin No. 10 of the Grand Canyon Natural History Society entitled "Plants of Grand Canyon National Park" by W. B. McDougall. So a supplement has been issued covering these points, and is available to all who have copies of the original bulletin.

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SOIL PROS AND CONS

(Continued from page 137)

they will eat the plants that are grown on soils that have been supplied with all essential minerals. There is some evidence from England that animals prefer to graze on pastures that have a high-humus content. But comparative research as to the relative value of chemicals and organics is still in swaddling clothes.

There is no conclusive evidence, that I have seen, that the use of chemicals, either as plant food or as insecticides, necessarily "poisons the soil." Advocates of organic gardening assert that the soil *is* poisoned, and also make strong claims that soils on which only organic fertilizers are used (i.e. humus) are immune to attacks by insects and plant diseases. If this is true, we have been on the wrong track for fifty years, and the manufacturers of both fertilizers and insecticides, excepting of course those that are purely organic, had better look for some other means of livelihood. And a lot of agricultural chemists, soil and crop experts, county agents, and good gardeners and farmers everywhere will have to hide their heads in shame for having been wrong so long.

Meanwhile, what is the average plain dirt gardener or farmer to do? As one of these, I will tell you what I intend doing:

1. Use more manure and other organics, and especially humus, which I shall faithfully try to prepare according to scientific methods.

2. Use mulches of straw, hay, leaves and other materials as much as possible between the plants in rows and elsewhere. I even intend to try sawdust and sea kelp for this purpose.

3. I shall also apply generous amounts of agricultural lime, to sweeten the soil and to keep it sweet where the organics are applied.

4. If I can locate a source, raw rock phosphate will be tried in comparison with superphosphate. I shall watch the earthworm population to see whether it goes up or down.

5. I shall continue to use chemical fertilizers on vegetable crops, but will leave check rows to see if any difference can be noted.

6. When my beans, squashes, corn and other plants are infested with either biting or sucking insects, I will apply insecticides including both rotenone (organic), DDT, and other chemicals. I shall also continue to apply copper and other fungicides whenever these seem to be called for. But I will *not* apply either insecticides or fungicides indiscriminately and in overlarge doses.

7. The use of 2,4-D and other selective weed killers will be carefully controlled. Naturally it is both careless and stupid to apply a weedkiller to a plant that one does not wish to kill. Those which poison the soil must be used only on walks, drives and in other spots where no plants are wanted.

8. I shall continue to spade or plow my garden except possibly for check strips to see how it works without the annual turnover. Cultivation with a wheel-hoe or hand hoe will be continued except where mulching is heavy enough to make it unnecessary.

9. Our heavy eastern soils, as well as those that have been worked a long time in humid regions elsewhere, often build up a hardpan underneath. If I can locate proper equipment I should like to try subsoiling, a process which has been very successful in renovating old soils and pastures in England and elsewhere. Subsoiling to a depth of two feet every four feet aerates the soil and improves its bacterial content and mechanical character without much change in the character of the topsoil.

In short, I shall try to keep up to date in my gardening, and to do everything that is compatible with progress without going overboard for every new whim, device or fancy that comes along.

One learns by reading, from the experience of others, and also by personal experimentation and practice. The claims of the organic gardeners must be considered and their evidence examined. There is much good in their teachings, if only to call attention to the need for a much greater use of humus. But we must not be stampeded by sweeping assertions that all chemicals poison the soil, and that healthy people and animals can *only* be nourished on foods grown on soils that are fed by organic fertilizers. No doubt healthier people and animals *are* produced when they consume an abundance of fresh foods, but there is *no* conclusive evidence that fresh foods grown with humus are superior to the same foods grown with well-balanced chemical fertilizers. Nor is there sufficient proof that diseases of plants or men, or insect pests have become more prevalent because of the use of chemicals.

Donald P. Hopkins, an English writer and soil student, whose book *Chemicals, Humus and the Soil* has just been published in this country (Chemical Publishing Company), presents the best popular treatise of these questions that I have seen. Among other points that he makes is the fact that there is no such thing as a "natural agriculture." The entire business of gardening and farming is artificial, and cannot be otherwise. Most cultivated plants that are used for food are incapable of living in a wild state, and if they were not fed artificially and protected from the diseases and pests that have become more numerous and more virulent in their attacks, because of the nature of our agriculture, they die.

Other interesting books on this subject are *The Organic Front* by J. I. Rodale, Rodale Press, and *The Soil and Health* by Sir Albert Howard, Devin-Adair.

HOW TO KNOW THE PLANETS

(Continued from page 141)

even the *nearest* of the stars that the stars appear to us fixed in space, although actually they are moving with velocities of a number of miles per second.

One soon gets so well acquainted with the planets through continual observation that they often can be identified by their colors alone. Mercury always will be seen in the twilight hours, and then only for a period of ten days or two weeks, including the dates of greatest elongations from the sun. It will always be brilliant, brighter indeed than a star of first magnitude, when picked up in bright twilight near the ecliptic. Venus should be the easiest to identify of all the planets, since it is the most brilliant of all celestial objects except the sun and moon.

A brilliant white in color, it should never be mistaken for Jupiter, which is definitely a golden-yellow. Venus will be found alternately in the morning or evening sky, never more than about 45 degrees from the sun at most. Mars and Saturn are the two planets most easily mistaken for stars. Mars, when closest to the earth at a very favorable opposition, is for a short time more brilliant than Jupiter, but at an unfavorable time, when farthest from the earth, it is not even as bright as a second magnitude star. It also passes through the zodiacal constellations of Scorpio and Taurus, and may at times be mistaken for Antares, or Aldebaran, by one not familiar with it. Saturn is usually comparable with Capella, or Arcturus, or Vega, in brightness, and is a pale yellow in color. Once identified by its rather peculiar color, one is not apt to mistake Saturn for any other planet, or star. Saturn moves more slowly relative to the stars than any other bright planet, so, once identified, one can easily keep track of it.

In March both Mars and Venus will be too close to the sun for observation. Mercury may be seen early in the month in the morning twilight. Mars will be in conjunction with the sun on March 17, and will be too close to the sun to be seen throughout the month. Jupiter is now visible in the southeast in the morning sky for some time before sunrise. It is in Capricornus. Saturn is still in Leo, high in the eastern sky at sunset. This is a fine time to get acquainted with this planet and to observe its motion with respect to the nearby first magnitude star, Regulus, which lies to the southwest of it. Saturn is still retrograding, having been at opposition in February.

Spring will begin in the northern hemisphere, and fall in the southern hemisphere, on March 20, at 5:49 P.M., Eastern Time. The sun will then cross the equator from south to north.

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6. *"For Sale" ads must state prices:* A specific price must be stated on all FOR SALE ads —except that the phrase "write for catalog" may be used when listing real estate or merchandise in quantities.

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Under the Microscope

By JULIAN D. CORRINGTON

BIRD CLOTHING

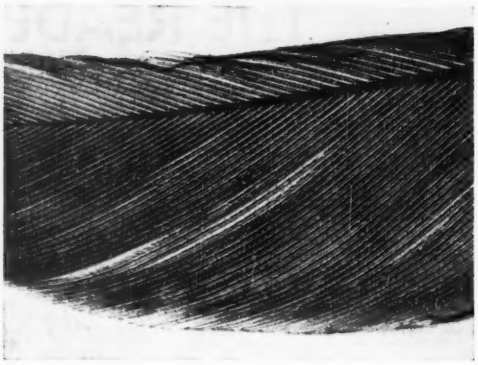
THE vestiture of birds is absolutely unique; so much so that a bird is sufficiently characterized by stating that it is a feathered animal. No other natural object in our world has feathers, yet comparative anatomists and embryologists, contemplating the clucking hen, can see the lizard peering out at them from behind this masque of fancy clothing, for as a bird is but a glorified reptile, so a feather is no more than an enlarged and subdivided scute—the correct term for a reptilian "scale."

Feathers have always been axiomatic for their combination of those opposed properties, lightness and strength, and, indeed, natural selection has produced no structure more beautifully and perfectly adapted for the work it is designed to perform. A brief study of a wing feather will provide the background needed for an appreciation of this statement.

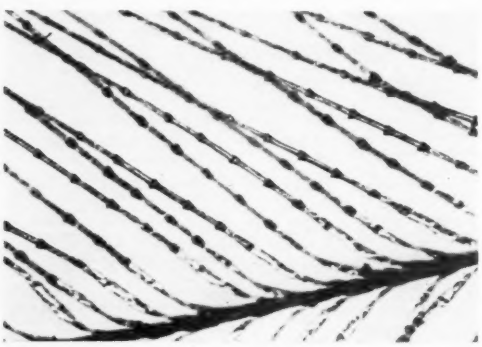
Among the several kinds of feathers, those that appear externally as the body covering and which comprise the wing pinions and tail are designated as *contour feathers*. Obtain several of these, if you can, the barnyard biddy being the readiest source for most persons although, at the moment, you may have to fall back on that 1927 milliner's creation reposing in an attic trunk.

The main stem of the feather is the *shaft*. That part bearing the vanes or webs is the *rachis* (also spelled rhachis, pronounced ray-kiss), while that without vanes is the *calamus*, barrel, or quill. The rachis is grooved on the side next to the bird's body, while the calamus is not grooved, but cylindrical. There is a tiny pit, the *upper umbilicus*, at the junction of calamus and rachis, where the vanes begin; also a *lower umbilicus*, a small hole in the end of the quill that provided a passageway for blood vessels and a nerve while the feather was developing. The calamus is hollow, the rachis filled with pith. The *aftershaft* is an accessory plume, often duplicating the main feather, generally in miniature, arising near the upper umbilicus. It may be nearly as large as the main shaft, or small to minute, and even absent altogether.

Springing from each side of the rachis is a *vane* or web, often downy at the base but soon becoming flat, firm, and closely knit. Careful inspection, especially with low magnification, or manipulation with the fingers, will reveal that each vane consists of a large number of rod-like branches set parallel and closely together. These are the *barbs*. They are not of equal length on the two vanes of a feather, as a rule, those of the outer vane being shorter, coarser, and set at a more acute angle to the shaft than those of the inner vane. On both webs the barbs decrease in length in passing toward the tip of the feather, which is generally rounded, but may be quite definitely pointed in wing feathers, or spined in the tail feathers of woodpeckers and swifts.



Contour feather with shaft and barbs, 6.5X



Barbules of down feather, 145X.

The barbs resist deformation as one handles them, and it is a common experience to note that once the continuity of the vane has been broken it cannot be restored. The reason becomes apparent upon magnification. If a small square is cut from one vane of a feather and mounted for study under the microscope, each barb is seen to be a miniature feather of a secondary order; that is, the barb being regarded as the shaft, there is a series of rods, like the barbs of a feather, projecting from each side. These are *barbules*. Those on the upper side of a barb, designated as *distal barbules*, overlap the *proximal barbules* from the lower side of the barb next above, and end in frayed-out filaments, the *barbicels*. Among these are certain lower ones that constitute minute hooks, the *hamuli*, and these, as well as plain barbicels, engage *flanges* on the proximal barbules. There is thus a dovetailed, interlocking arrangement of very minute parts that makes a firm vane. The condition is somewhat analogous to the hooks and trough by means of which bees and wasps fasten together the two wings of a side.

Certain classes of contour feathers receive special names. All flight feathers of the wings are *remiges* (the singular of this word is *remex*, scarcely ever used), divided into *primaries*, the largest and stiffest feathers, from the hand; *secondaries*, from the forearm; and *tertiaries* or tertials, from the upper arm. Smaller, softer *wing coverts* overlap the flight feathers on both surfaces of the wing. *Rectrices* (singular, *rectrix*) are the prominent feathers of the tail, and there are both upper and under *tail coverts*.

Contour feathers do not occur uniformly all over the body, but in definite tracts called *pterylae*, with bare patches of skin, the *apteria*, between. No apteria are visible externally since they are amply covered by feathers from adjacent pterylae.

Down feathers are soft and fluffy, and occur on young birds and next to the body of adults, underneath the contour feathers. The rachis is absent or is short and soft; the barbs are flexible and soft, the barbules are fine and hair-like and there are no hamuli, the barbs not being hooked together into a vane. *Semiplumes* resemble contour feathers in having a shaft with two webs, but are like down feathers in the lack of hamuli. The *filoplume* (thread-feather) superficially resembles a hair. It has only a shaft with a few terminal barbs. All three of these smaller kinds of feathers—down, semiplume, and filoplume—are to be found on most birds, especially on the breast, among

Barbules and barbicels of contour feather, 145X.

the bases of the contour feathers. A fifth type, occurring only on certain birds, notably herons and parrots, is the *powder-down feather*. These are down feathers that grow continuously, the tips disintegrating all the while into a powdery material.

The foregoing survey of construction of a contour feather displays an amazing engineering accomplishment. The use of horn instead of bone is equivalent to employing aluminum in place of steel for airplane wings. The shaft is hollow rather than solid, a well-known structural principle whereby strength is gained and weight reduced. A hollow tube is much stronger than a solid rod containing an equal weight of material. Cutting up the substance of the feather into myriad fine elements, instead of having it in the form of a thin and flat but solid scute, not only lessens the weight but also provides a multitude of tiny air spaces within the substance of the feather itself. These, together with the dead-air spaces between successive layers of feathers, and, especially, among the filaments of down feathers, give the bird the most efficient of all natural thermostats. Body heat is retained and conserved, even in arctic climes. The lightness of the whole plumage is in line with such anatomical specializations as hollow bones, air sacs, exceedingly light skeleton with many fused parts, and absence of teeth, that make this heavier-than-air flying machine as buoyant as possible.

There would seem to be little in common between feathers and hairs, at first glance, yet they are equivalent structures, developing in the same general manner. In cross-sections of chick and pig embryos one may study the way in which an area of epidermis folds inward to form a tubular sac, the *follicle*. When fully formed, like the finger of a glove turned wrong side out, the bottom turns and grows back upward through its own channel, fed by a connective tissue *papilla* from below. The feather or hair is a living and growing organ at this stage, with its own blood vessels and nerves. That part which later protrudes beyond the level of the skin is, in each case, almost pure keratin or horn, and is a dead structure. Hairs continue to grow from their roots; feathers (except powder-downs) do not.

Exposed to wear and tear, feathers eventually wear out. This would be disastrous, so before it can happen, in the normal course of events, the feathers loosen in their follicles and fall out. The bird sheds its feathers, or *molts*. Each species has its own life-cycle pattern, with characteristic *plumages* succeeded by molts. Thus, the young chick is first covered with *natal down*, which is shed at the appropriate time by means of the *postnatal molt*. Now comes the *juvenal plumage*, the first one that includes any contour feathers, and this is lost in the autumn by the *postjuvenal molt*, the new suit of clothes being the *first winter plumage*. In some birds, this is shed at a *prenuptial molt*, providing still another set of feathers, the *first nuptial plumage*; in others the first winter plumage may be retained to serve through the spring without any prenuptial molt.

Normally, birds shed twice a year thereafter, with *pre-* and *postnuptial* molts preceding and following the breeding and nesting season, but there are many variations. The postnuptial molt is always present and complete, so that all birds get a full change of raiment at least once a year; the prenuptial molt, on the other hand, is seldom complete and often omitted. In any molt the feathers are not shed all at once, but a few at a time, ensuring continuous protection, and, with rare exceptions, at least some ability to fly.

Plumages vary with age and may vary with sex and season. All young birds are different from their parents since none have contour feathers; in a few cases several years are required before assumption of the full adult plumage. The males of ducks and many of our familiar song birds, as orioles and tanagers, are much more gaily dressed than their more somber mates, while in phalaropes it is the female that puts on the glad rags. Spring males of the bobolink and many warblers are brilliantly decked, but their winter plumage resembles that of the female more or less closely.

Color in feathers is due to one, or both, of two factors. During growth, any of three pigments may be deposited in the feather—red, yellow, or brown, or combinations thereof, providing a *chemical color*. In many cases, this layer is capped with a non-pigmented layer of tissue, the minute structure of which acts as a diffraction grating, breaking up the incident light so that some wave-lengths are absorbed, others reflected, giving a very different appearance from that which

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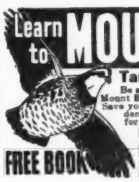

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the pigments would otherwise produce. Thus, green, blue, and metallic and iridescent colors are, with rare exceptions, *physical colors.* If you can secure a number of feathers whose colors are different—naturally different, not dyed—place them on a table and observe them by reflected light, then hold them up and look through them toward a window or lamp, viewing them by transmitted light. The results are often surprising.

Feathers have played a greater role in the history of civilization than most persons would suspect. Savage tribes and barbaric peoples universally used them as items of personal adornment, equivalent to the costume jewelry of today, and often as a symbol or badge; the eagle feather for leadership or bravery, the white feather for surrender or cowardice, the peacock tail-feather for opulence. The exquisite kingfisher-feather jewelry of the Chinese is priceless now. Fans, boas, shoes, but most of all, headdress, from the Sioux war bonnet to aigrettes, have all played their part in catering to the ego. Even whole costumes have sometimes been made of feathers; where would Sally Rand have been without her feather fans?

From the standpoint of utility one thinks immediately of feathers as a filling for pillows, especially goose feathers, and of feather beds. We cradle our tired heads in a bird's breast every night. Arrow shafts are feathered, a savage discovery in ballistics of truly remarkable acumen. Try to take his feathers away from a trout fisherman and you will have a fight on your hands. But by far first in importance is the pen that is mightier than the sword. Sharpened quills, split at the tip, have written the pageantry of the human species ever since there was a prepared surface on which to write. The word *pen* is from the Latin *penna,* a feather, and "goose-quill" formerly indicated a pen for writing. The feather, until relatively recent times, has inscribed all the great works of the world's literature. Our heritage is founded on flight feathers furnished by the goose, probably the oldest of man's domesticated birds.

Birds of a feather flock together;
Feathers of birds inscribed our words.

REVIEWS

Biology The general reader usually shies away from most standard textbooks of scientific subjects; they are to be studied rather than read, and are most effective when combined with lectures, recitations, and laboratory work. An outstanding exception is *Life Science, A Survey of the Various Fields of Biology,* by M. W. de Laubenfels. If you are a teacher, a student, or merely a devotee of things biological, you cannot afford to miss the experience of looking through this volume.

The treatment is highly original and different. The author chats with you rather than lecturing at you, and his points are illustrated by the largest number of line cuts and photographs of any book of the sort we have seen—an average of 3.16 illustrations per page. Both the style of writing and these 1024 illustrations make this book an enlightening and entertaining survey of modern biology.

Dividing the material into eight parts and twenty-six chapters, the author asks and answers a question with each, or discusses a topic. The key words designating each chapter are: biology, biophysics, biochemistry, cytology, embryology, histology, anatomy, physiology, psychology, hygiene, immunology, dietetics, botany, taxonomy, bacteriology, zoology, oceanography, parasitology, entomology, zoogeography, ecology, genetics, eugenics, paleontology, anthropology, and philosophy. This enumeration will emphasize the comprehensive coverage. Third ed., rev., pp. iv, 340; 745 drawings, 279 photos. Prentice-Hall, Inc., 70 Fifth Ave., New York 11, 1946. $6.35.

Anatomy William H. Atwood's *A Concise Comparative Anatomy* is well named. The author has successfully solved a major problem in the writing of zoological texts, that of condensing the tremendous amount of material generally deemed essential so as to provide a volume suited to a one-semester course. We may argue that sixteen weeks are ample in which to read a large book of, say, 700 to 800 or more pages; but those who would maintain this view are certainly not realists in regard to the college sophomore. A weighty tome so repels him, he will probably end by not reading the book at all. Atwood's anatomy has but 367 small pages of actual text, and the 303 illustrations account for about a fourth of even that small footage.

In spite of these praiseworthy, self-imposed limitations—the author must have been sorely tempted to expand on almost every page—the coverage is admirably complete. All of the customary morphological problems and findings are given. There is no space for the detail of Hyman, nor for the delightful, story-telling approach of Walter; the material is necessarily condensed and terse. The book must be studied, not read. There is much to learn on each page, but we feel the student will be attracted and will finish this book, since it will seem to him to be no more than an expected normal load—only about 25 pages per week. Pp. 413, figs. 303. The C. V. Mosby Co., 3207 Washington Blvd., St. Louis 3, 1947. $3.75.

SONGS FOR THE LABORATORY

Bones

(Air: My Bonnie Lies Over the Ocean)

I

My bones cause cerebral commotion,
I'm trying to learn all their names,
I work at the skull with devotion
But find it the hardest of games.

Chorus:
Bones, bones, bones, bones—
I'm naught but a haystack of crazy bones,
Bones, bones, bones, bones—
Oh why must I learn all these bones?

II

My sphenoid consorts with my magnum,
My coccyx lies inside my ear;
My mastoid is filled up with sphagnum,
My bones are all jumbled, I fear.

(Chorus)

III

Last night as I lay on my sternum,
I dreamt I heard osseous moans;
They came and implored me to learn 'em,
And unscramble all of my bones.

(Chorus)

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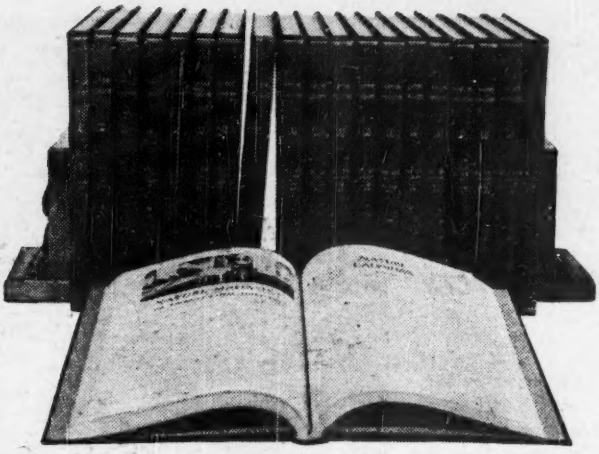

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